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WIDER TRADE HORIZONS.

A perusal of the report in our pages this week of the work of the International Commercial Congress will help toward a better understanding of the newer conditions upon which our industries have entered. Wider trade horizons have opened up all around us, so that topics are now of interest and even vital that did not greatly concern anybody a few years ago. We need offer no apology for devoting so much space to these matters, for they not only touch the welfare of every electrical exporter in this country, and importer, but have brought to our shores for their discussion some of the foremost electrical manufacturers and engineers in Europe. Not only are our relations with the old world affected, but the opportunities in the Far East and in South Africa and in South America are brought to notice and consideration. It is clear from the work of the congress, that while Americans have still much to learn in building up foreign trade the process has begun and the pupils are apt. It would be difficult, for instance, to find a more inspiring picture than was presented by Mr. Eddy as to the introduction of the American trolley system in Buenos Ayres, and yet that plant could be matched by others in different parts of the world; and new openings are still being created. Mr. Robert P. Porter, who has just returned from a long investigation in Europe, speaks of Russia as one of the best fields in which our manufacturers can push, while at the same time he speaks hopefully of South Africa and of the open markets and equal rights that England gives wherever she advances her flag. In both France and Germany he sees also improving conditions for interchange of products with us, and on the whole he considers that, if there is the right amount of push, it will not be a difficult matter to increase the volume of foreign trade, which in manufactured goods reached $336,000,000 for the year ending June 30, 1899.

THE AMERICAN PHYSICAL SOCIETY.

The astronomer Huyghens, in an apologetic fashion, when speaking of his discoveries in regard to the planet Saturn, said that even among the learned there were some who would chide him for his interest in things remote and advise him to turn his attention to matters of a more practical nature. In calling attention to this timid but proud apology, Prof. Simon Newcomb a few years since justified the science of astronomy for its own sake, rather than for the sake of its application, and held that in the spirit of scientific progress we saw patriotism in its highest form, a form which overleaped the artificial boundaries of geography and statecraft, a patriotism which knew as its only rivalry the ambition to contribute most to the sum of human knowledge. Last week at the meeting of the American Physical Society in this city, Prof. Rowland in a vein familiar to those who have watched his career and his utterances, expressed sentiments not less noble and dignified. The young scientific body of which he is president could wish no finer evangel than his beautiful and searching address.

The world is too much with us, is the echo and refrain of the scientist who pushes the outer world away in order that he may get nearer to the inner one. There was once a mathematician

who thanked God that his science was one which could never be prostituted to any useful purpose. Prof. Rowland is not exactly of that class or stripe of infecund intellectual ascetic. But he does maintain that we must seek out the fact for itself, regardless of its possible practical value, and in that opinion lies the salt of existence, all that makes the higher life worth living. After all, there is something that takes care of the lower issues. Saul in looking for his father's asses found a kingdom, and the humble physicist tracking to its lair some obscure phenomenon has ere now time and again, opened up to mankind a new heaven and a new earth.

Under a leadership of such lofty courage and inspiration as that with which it has begun its work, the American Physical Society should go far. We may expect from it many valuable records and much original research. Its list of members may not be large, and as Prof. Rowland fitly deplored, their tangible equipment available for scientific conquest may be pitiably grotesque and insignificant compared with that readily furnished for bloodshed, but we all know there will be results and we believe they will greatly advance our knowledge of electricity and of the constitution and laws of the universe. What more could be asked of any body of modest, self-sacrificing men?

THE CENTENARY OF THE ELECTRIC CURRENT.

Dr. Fleming's lecture of this name, given at Dover last September, makes a good-sized pamphlet, discussed in our review column. The keynote of this discourse appears to be that it is to the laws of ether and its activities that we must look for the explanation of the phenomena of the electric current; or, in other words, that conducting matter is only the guide and that the current is led through the dielectric ether.

The great generalization of the nineteenth century in the department of electromagnetism seems to be that no electric disturbance can be propagated without evoking magnetic disturbance; and vice versa, no magnetic disturbance propagated without electric disturbance—the two being inextricably associated by whatever activity of the ether effects the transmission. All electric and magnetic disturbances are, moreover, the counterparts of hydrostatic or hydrodynamic disturbances, showing that the ways of electricity and magnetism are the ways of ether streams, as distinguished from the ways of rigid substances, such as solid conductors. For this reason it becomes impossible adequately to study either electricity or magnetism alone. Each must be studied and comprehended in its mutual relation to the other. This is equally true, both in the theory and in the practice of electromagnetism, for at the present time our dynamos, motors and transformers involve the mutual relations of electricity and magnetism in their most intimate connection.

As a further consequence of this association, the moment that we are enabled to interpret the nature of the ether activity which we call electric energy, we shall necessarily also infer the nature of the ether activity which represents magnetic energy, and reciprocally, since the mutual relation of the two things is known without an adequate material conception of either independently. It remains apparently for the twentieth century to throw light upon the nature of these ether activities whose solitary waves constitute electric and magnetic induction, and whose wave trains constitute light.

Whether the knowledge and interpretation of the dynamics of the ether would enable us to build better dynamo-electric machinery is, of course, open to doubt. It might be that we should merely gain a deeper insight into the phenomena recognized by our senses, and an explanation of their mutual relations; but, on the other hand, it is always possible that a complete and satisfactory theory of electromagnetism might open up and suggest new avenues of utilization that would be of vast advantage to mankind. At all events, we may be certain that the new knowledge, whenever and however attained, will represent new power.

Dr. Fleming introduces a term which appears to be new and which possesses obvious advantages, namely, "electric pliability," which is synonomous with what is commonly known as specific inductive capacity, and is represented by the symbol K. It corresponds in electrics to permeability in magnetics, and is the ratio of electric displacement to electric force. The term "energivity is also used for the energy per unit volume in a medium.

THE WARSAW PROPOSED MUNICIPAL CENTRAL STATION.

The description of the proposed Warsaw station, a first instalment of which appears elsewhere in this number, contains much that is of electrical engineering interest. The area of territory proposed to be covered seems to be about 15 square miles, and with a load in the immediate future not more than about 1500-kw, or only about 100-kw per square mile. Under these circumstances, we can readily understand that Mr. Lindley has favored the selection of high-pressure alternating-current distribution. Five thousand volts seems a rather high pressure for urban distribution in Europe, but we take it for granted that the mains and feeders are to be buried cables, in which case objections upon the score of danger disappear, and moreover, one may be killed with practically the same certainty by coming into close accidental contact with alternating service of 1000 volts pressure as of 5000. In other words, either pressure is safe when properly safe-guarded, and either pressure is practically of equal danger to life if not safe-guarded.

An interesting proposal is that which relates to steam turbines. We very rarely see a steam turbine in this country, while in Europe they have found steadily increasing favor. The principal objection to them has been their large steam consumption. But the more recent turbines seem to have shown improvement in this respect, as, for example, in the reported tests of the Turbinia. It is proposed to employ half the ultimate engine capacity in steam turbines of 1000-kw each, running at 1500 r.p.m., and with a consumption not exceeding 29 pounds of steam per switchboard kilowatt-hour. The project is to make use of these turbines for the peak of the load, and to use double or triple-expansion engines of the ordinary reciprocating type for the steady load, on account of their greater economy in fuel consumption. It is claimed that the steam turbine costs, roughly, 30 per cent. less than an engine of the same large size, while its steam consumption and operating expense are about 30 per cent. greater. At a frequency of 50 cycles per second, such a steam turbine would drive a four-pole 1000-kw alternator. An alternator of that character would be a curiosity in this country at the present time. Our 1000-kw alternators are more likely to have forty poles than four.

There can be little doubt that if the steam consumption of turbines could be reduced to that of the best types of marine engines, they would have marked advantages for central-station work. They are very compact and readily manipulated, while their simplicity leaves nothing to be desired. The oiling system of a large central station of the marine-engine type is quite an intricate network in itself, with pumps and mains complete, while the steam turbine only needs lubrication in its shaft bearings. There is almost complete freedom from vibration and noise, while all troubles from pulsation or variations of speed within the engine cycle disappear immedi-

ately. In fact, a direct-coupled steam-turbine alternator seems to be as near to the perfection of machinery for power transmission as the limitations of steam and mechanics will permit. A remarkable feature of the proposed plant is the large coal storage capacity for four months reserve under stress of winter weather. In this country such a large storage capacity would suggest a provision against strikes in the coal industry rather than against winter difficulties of transportation.

ELECTRICITY IN THE NAVY.

On another page we reprint from the annual report of Rear Admiral Melville, Engineer-in-Chief of the United States Navy, that portion which deals with the question of electrically-driven auxiliaries aboard warships. As will be seen, it consists of an apparently carefully prepared argument in favor of steam over electrically-driven auxiliaries—an argument such as might be expected to emanate from a steam engineering bureau. As showing how radically the position there taken is opposed to the current view among electrical engineers as to the adaptability and economy of electric motors aboard ship, we may refer, in passing, to an abstract in this week's Digest of an article recently appearing in the *Engineer* on "Electric Auxiliary Machinery in the Navy."

As to the weight of the charges against the electric motor based upon its alleged delicacy, unreliability and lack of ready adaptability for driving auxiliaries on warships, our readers are quite capable of judging, since the conditions aboard ship are not so radically different from those which obtain ashore as to require a marine training for their consideration. The general denial of claims of economy for electrically-driven auxiliaries we must assume to be based upon tests of small marine generating sets. Reports published of some naval tests of this type of electrical generating machinery have shown a consumption of over 100 pounds of steam per hp-hour. This, however, it should be needless to say, does not imply that the large generating sets required if auxiliaries generally aboard ship were electrically-driven, would prove similarly inefficient. Having in mind the general use of electrically-driven auxiliaries aboard ship—and it is against such general use that the arguments of the report are directed—it is strange to read the following assertion: "Now that the great majority of the auxiliaries on board ship are so near the boilers, less piping is involved in a direct steam drive than in an electric drive from dynamos necessarily at some distance from the boilers." In writing of their responsibilities, naval engineers are fond of enumerating the large number of engines under their charge aboard ship, these sometimes amounting to twoscore or more in the case of a large warship—each necessarily having a steam and an exhaust connection. Furthermore, the assumption is singular that dynamos necessarily must be located at some distance from the boilers, particularly in view of the statement that the great majority of auxiliaries can be placed in close proximity thereto.

In the Digest will also be found an abstract from the report of Rear Admiral Hichborn, Chief Constructor of the Navy, who appears to concede that "electric motors are especially economical where intermittent power is required at varying intervals," but who adds that a fear exists "in some quarters" that their general use aboard ship may necessitate sacrifices in such important elements as speed, armament and protection—the reason given in this case being that it is "a question still unsettled whether the weight of an electrical equipment will overbalance a steam auxiliary." We have not at hand the reports of the two other Navy Department bureau chiefs having also cognizance of naval electrical engineering, and we may therefore hope for some encouragement from these quarters. From one of these bureaus, however, this hope is a faint one in view of the sombre picture painted by its chief in his annual report of last year. In this report—that of the Chief of the Bureau of Equipment, who is the official electrical engineering head of the navy—much concern was manifested at the constantly increasing demands for repairs and renewals to the electrical outfits and supplies of warships. The statement was made that the number of officers who are familiar with electrical engineering seems to be decreasing rather than increasing, and it was recommended that a specially trained corps of officers and men be organized for naval electrical engineering service.

When we consider the present status of electrical engineering in the navy with respect to both materiel and personnel, it is not difficult to find cause for the unsatisfactory condition sketched above. Aboard ship the head of the electrical engineering department is the navigating officer, who may or may not have a professional knowledge of the branch whose duties he assumes in virtue of his function as navigator. At Washington and at the navy yards, four different bureaucratic departments have cognizance of electrical engineering. At the New York navy yard, for example, there will soon be three electrical plants installed within a few hundred yards of each other, and each as virtually independent of the other as if they were situated in different states. One will supply polyphased currents for power purposes to one set of shops, another direct current for the same purpose to some neighboring shops, and a third will generate current for lighting the grounds, some of the buildings and for miscellaneous purposes. If a steam engine is displaced by a motor, the installation of the apparatus passes from one bureau to another, notwithstanding that the function of the apparatus driven remains the same; and aboard ship there is a similar change of the officers in charge. It is evident that such a remarkable system must breed jealousies and contentions, and of the consequences electricity is apt to be the victim—in fact, has been and will continue to be until the present absurd conditions are changed.

In his report, the engineer-in-chief recommends that the electrical generating plant be placed in charge of his bureau, stating that such a change would conduce to the efficiency of the service, to the more extended use of electricity, and to an increase in the life of electrical apparatus. A short time ago, when the navy had a distinct marine engineering corps, much could have been said in favor of such a proposition. Even under the present régime the merit contained would hold so long as the engineers trained as such and recently absorbed by the line, remained in considerable numbers on the active list. But any rearrangement should be made with an eye to the day when the professionally trained engineer will have been eliminated from the navy, and this will occur before many years under the recent personnel reorganization legislation. Then but one permanent corps—the Construction Corps—will remain, comprised of professionally educated technical officers. As this corps now contains a number of officers who were trained as marine engineers, the transfer to it at some time in the future of the present functions of the steam engineering bureau appears most probable, and therefore the logical plan would appear to confide to this corps once for all the electrical engineering branch so far as relates to the electrical equipment of ships, with a provision that an electrical engineer from civil life and of high professional reputation shall be in immediate charge. The difficulty would nevertheless remain as to the electrical engineering personnel aboard ship. In view of the recent indorsement by Congress of the dogma that a warship must not have specialists among its complement of officers, the bureau recommendation above referred to of a specially trained corps of electrical engineer officers, is not apt to be considered. The most conservative, and therefore, most feasible, plan would appear to be to separate the functions of navigator and electrical engineer, and bestow the latter on such officer in the ship's complement as may be best qualified to exercise it.

Exports and Imports in 1899.

The table of imports and exports for the nine months ending with September, 1899, just issued by the United States Treasury Bureau of Statistics, gives some interesting facts regarding the classes of articles in which the increase of imports predominates and the classes most affected by the increase in exports. Importations have increased from $475,360,893 in the nine months of 1898, to $585,934,124 in the nine months ending with September, 1899. An examination of the imports by classes during that time shows that the increase is almost exclusively in articles used by manufacturers and foodstuffs, largely sugar and coffee. The class, "articles in a crude condition for use in domestic industries" increased from $148,937,651 in the nine months of 1898 to $190,252,298 in the nine months of 1899; articles partially or wholly manufactured for use in the mechanic arts increased from $44,547,097 to $51,957,507; articles of food and live animals increased from $140,816,034 to $178,630,447; manufactured articles ready for consumption increased from $79,477,943 to $87,918,981, and articles of voluntary use, luxuries, etc., from $61,582,168 to $77,148,899. Thus, articles for the use of manufacturers increased, in round terms, fifty million dollars; foodstuffs, thirty-seven million dollars; manufactures ready for consumption, nine million dollars, and articles of voluntary use, luxuries, etc., fifteen million dollars.

The export side of the nine months' statement is equally interesting. The total exports in the nine months, ending with September, are more than thirty million dollars in excess of those of the corresponding months of last year. An analysis of the statement by great classes presents some curious and suggestive facts, especially when considered in connection with the import figures. The exports of products of agriculture, for instance, are nearly thirty millions less than in the nine months of last year, while those of manufactures are fifty millions greater than those of the corresponding months of last year. This enormous increase of fifty million dollars in the exports of manufactures is especially interesting when considered in conjunction with the increase of fifty million dollars in imports of raw material for use of manufacture. Exports of manufactures in the nine months ending with September, 1899, amounted to $277,502,649, against $227,822,045 in the nine months of 1898, and formed 31.34 per cent. of the total exports, while in the corresponding months of last year they formed but 26.66 per cent. of the total exports. Products of the forests and mines also show a material increase in exportation, those of the mines having increased from $19,159,887 in the nine months of last year to $23,640,720 in the nine months ending with September, 1899, while the exportation of products of the forests increased from $30,775,578 in the nine months of 1898 to $36,129,159 in the nine months of 1899. Agricultural products show a decrease in value of exportations of twenty-nine million dollars in round terms, the total for the nine months of 1899 being $542,114,469, against $571,294,955 in the corresponding months of the preceding year. This decrease, however, lies more in reduction of values than in the amount exported.

Wireless Telegraph Tests in the U. S. Navy.

Tests were made last week by the United States Navy as to the practical value of wireless telegraphy. The cruiser New York, Admiral Farquhar's flagship, and the battleship Massachusetts were selected for the experiments and were equipped with apparatus by Mr. Marconi. The two vessels lay at their anchorage off Thirty-fourth Street, North River, 480 yards apart, or about the distance that would separate vessels steaming in squadron formation. The sending instrument was operated on the flagship by Mr. Marconi personally, with an assistant, and directed by two members of the naval board, Lieutenant Commander Newton, of the New York navy yard, and Lieutenant Frank K. Hill, of the cruiser Prairie.

The receiving was done on the Massachusetts, the instrument being operated by one of the inventor's assistants, under the inspection of Lieutenant John B. Blish, of the bureau of equipment. The particular object of the first tests was to determine the practicability of using the system for short signaling while squadrons are at sea.

The first test was the sending of the contents of a newspaper article of about 1500 words. This was sent and received without a single error, at the rate of eleven words a minute. The message after being sent to the Massachusetts was repeated back to the New York, the words being registered on tape which was taken by the inspectors and duly filed away. The second test was the sending of a series of numbers of varying lengths which were ticked off with a little more rapidity than the previous message. Test No. 3 was the sending of a series of letters written, drawn at random. The fourth test was the sending of a series of short messages. The fifth and sixth tests were the transmitting of a series of code messages. These were enough to tax the skill and patience of the operator, the words having to the uninitiated absolutely no sense or meaning. There were one or two errors discovered in these tests, but Mr. Marconi explained that these as well as the speed were purely tests of the ability of the operator.

The New York and Massachusetts then left for a trip to sea to further test the new system. A third vessel was anchored off Navesink Highlands and Mr. Marconi had an instrument and assistant at Sandy Hook. It will be determined just how far the instruments will carry between vessels and between a vessel and the shore. The inventor claims that his instruments as now constructed will operate successfully eighty miles apart.

One feature of the test is the firing of the big guns of the warships while the messages are being sent, to determine the usefulness of the system during an engagement. The tests have been somewhat interfered with by the gales of this week.

Electric Railways in Buenos Ayres.

The municipal authorities of Buenos Ayres, says the Bureau of American Republics, have decided to repeal the ordinance which required the free lighting of streets traversed by trolley lines, which is said to mean the practical wiping out of the horse tramway by the substitution of electrical means of locomotion. There are now ten horse car companies in the city. The first electric line was introduced there three years ago, and although merely experimental, was a success from the start. To-day there are two electric railway companies in the city operating 40 miles of track, and constructing more as fast as material can come from the United States, for only American equipment is used. These two companies are controlled by English capital. Each of the two principal horse roads, also owned by English capital, carries about 30,000,000 passengers yearly. Since the repeal of the objectionable law one of these companies contemplates the adoption of electrical power, and conservative opinions estimate that at least $10,000,000 will find their way into United States pockets owing to the proposed immediate conversion of the principal horse lines into electric lines. This sum is exclusive of that necessary for the erection of power plants for the supply of electric light.

The following table shows the movement of the ten companies during July last:

	Horse.	Electric.
Kilometers of line	362	63
Cars in service	816	79
Employees	4,655	604
Horses	10,897	....
Round trips	269,809	39,863
Passengers carried	8,246,458	1,310,933
Kilometers	2,877,084	464,676

During the months from March to July, inclusive, the number of passengers carried by the horse cars was 42,511,913, and by the electric cars 5,585,232.

The *Review of the River Plate* for Aug. 19, 1899, says that the Department of Public Works of the municipality of Buenos Ayres has drawn up the specifications calling for tenders for the construction and working of a network of electric tramways connecting the suburbs of Villa Devoto, Catalinas, Crespo and others. The system is divided into three sections, and the charge for passengers is fixed at 10 cents per section, or 25 cents for the three. Those who present tenders (unfortunately the time limit for these tenders is not named) will be required to deposit the sum of $20,000 as a guarantee for the carrying on of the work. The *Street Railway Journal* for October contains a very elaborate article on the present electric railways in Argentina.

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Series Alternating Current Arc Lighting from Constant Current Transformers.

At the September meeting of the American Institute of Electrical Engineers, Prof. W. L. Robb read a paper on series alternating current arc lighting, based upon his experience with the installation on that system which for some months has been in successful operation at Hartford, Conn. Owing to the great interest at present manifested in the subject, we reprint below the paper in full, accompanied by a number of illustrations that do not appear in the original paper as printed by the Institute.

In all long distance transmissions of electricity, and when large areas are supplied from a single advantageously located power plant it is necessary, at least in the present state of the art, to generate and transmit alternating current.

In general it will be found desirable to supply current to the street lights from the same secondary mains that supply the current for the commercial lighting and power. There are, however, in most places large districts in which the streets are lighted by arc lamps, and where there is no commercial lighting or power. These sections can be most economically lighted by series arc lights.

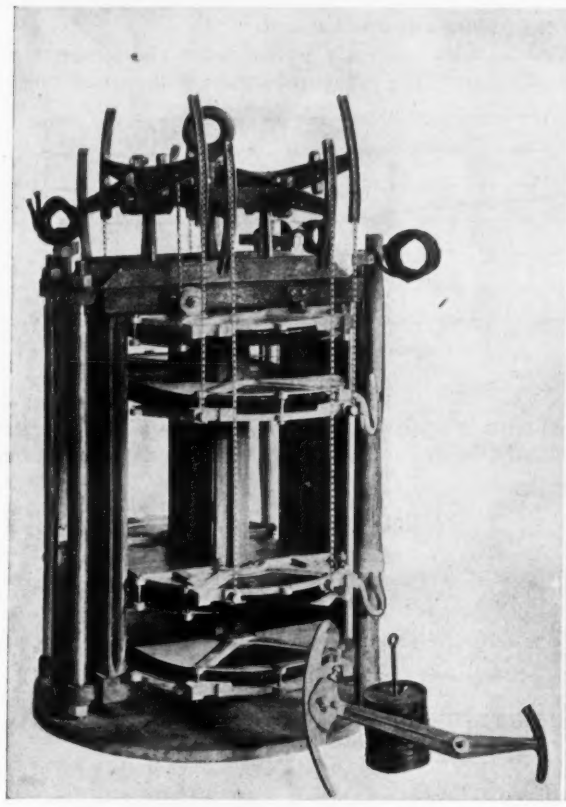


FIG. 1.—100-LIGHT CONSTANT-CURRENT TRANSFORMER.

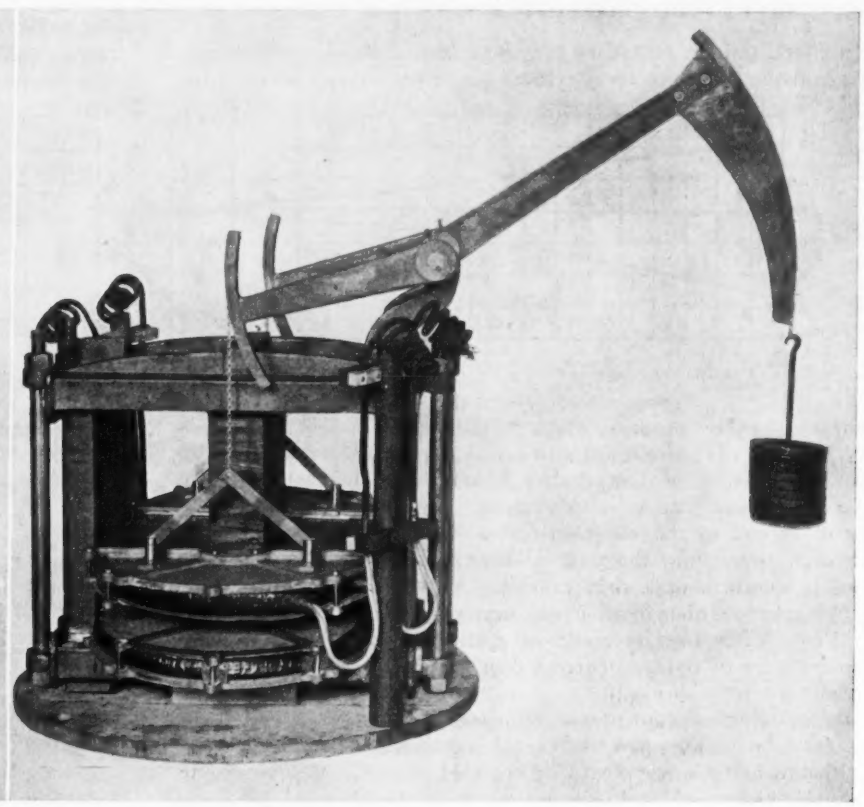


FIG. 2.—25-LIGHT CONSTANT-CURRENT TRANSFORMER.

Various methods of operating series arc lamps from alternating current systems have been suggested and are in successful operation. In several well-known stations in this country, continuous current series arc dynamos are driven by synchronous or induction alternating current motors, the arc dynamos being either direct-connected to motors or belted from a line shaft which is driven by motors. In England, direct-current series arc lamps are operated successfully from rectifiers. In 1896 the Hartford Electric Light Company decided that it would be advantageous to make a radical change in its system of series arc lighting, with a view to obtaining a greater economy of operation. The series commercial arc lamps and the street lamps in the same section of the city were changed over from series open-air arc to constant potential arcs. It was considered advisable to continue the series arc lamps for lighting the outlying portions of the city. Propositions were considered both for using motor-driven series arc dynamos and for using rectifiers. An order was finally placed with a manufacturer for a rectifier. A satisfactory rectifier never materialized, and attempts were unsuccessful to import one from Europe.

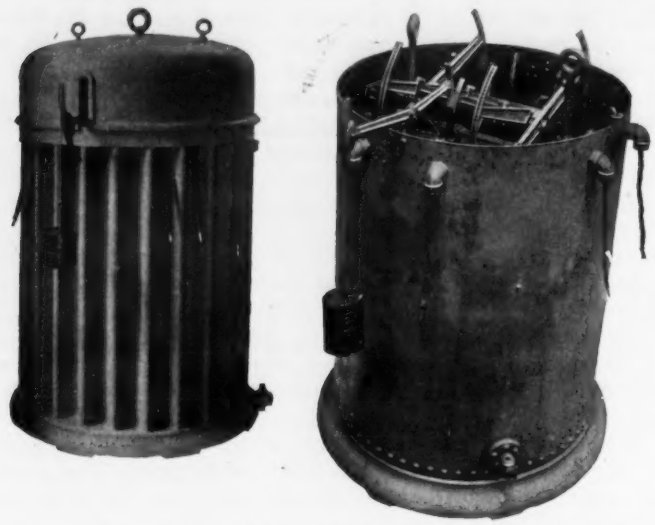
The development of the enclosed arc lamp quickly led to the evolution of a satisfactory alternating current arc lamp of the constant potential variety. The perfection of this lamp led Mr. Richard Fleming, one of the engineers of the manufacturing company, to suggest the advisability of operating series alternating arc lamps from the constant current transformer, which formed one of the essential parts of the rectifier.

An experimental transformer having a capacity for operating 30 lights in series, was installed in April, 1898. After being subjected to a thorough test in the central station it was put in practical operation on a street circuit. The results of these tests were so satisfactory that an order was soon placed for several transformers, each having a 100-light capacity. The first of these transformers was installed about a year ago, and during the year all of the continuous current series arc dynamos have been replaced by constant current transformers.

Each transformer is enclosed in a cylindrical tank. The tanks were originally made of boiler iron riveted up, but it proved impossible to keep these tight against the transil oil in which the transformer is immersed. The tanks are now made of cast iron.

The core of the transformer is of the sheet type, with a large central vertical core rising the whole height of the tank. This central core is surrounded by the primary and secondary coils and the magnetic circuit is closed by return paths outside the coils. In the larger transformers as made by the General Electric Company there are two primary and two secondary coils. One of the primaries is fixed at the bottom, and the other at the top of the central core. The two secondaries are free to move up and down between the primary coils, and are so connected together that when one falls the other rises. They may approach into contact with each other at the middle of the tank, or from this position one may rise toward, the primary coil at the top while the other falls toward the primary coil at the bottom. Connected with the chains by which they are balanced is a lever which extends outwardly from the top of the oil tank and carries depending from its outer end a heavy adjustable weight. The lever is supported on a hardened steel knife-edge. This weight tends to force the two secondary coils respectively toward the two primary coils. In the smaller sizes of transformers there is but one primary and one secondary coil. When the transformer is in operation the currents induced in the secondary react upon those in the primary and tend to force the coils apart. This force is balanced for the desired normal current by the adjustable weight outside of the

case. If the resistance of the secondary circuit falls, due to the cutting out of lamps, the current increases slightly, increasing the repul-



FIGS. 3 AND 4.—CASES OF 25-LIGHT AND 100-LIGHT CONSTANT-CURRENT TRANSFORMERS.

sion effect, and the secondary is pushed further away from the primary, giving a chance for increased magnetic leakage between the primary and the secondary, which reduces the e. m. f. in the secondary, bringing the current down to practically normal, even with wide changes of resistance. The regulation obtained is adjustable by means of a cam-shaped segment which can be moved on the outer end of the weighted lever. The construction adopted by the General Electric Company is shown in Figs. 1, 2, 3 and 4.

The principle of regulation was first suggested by Prof. Elihu Thomson, and its application to the operation of constant current transformers is broadly patented by him.

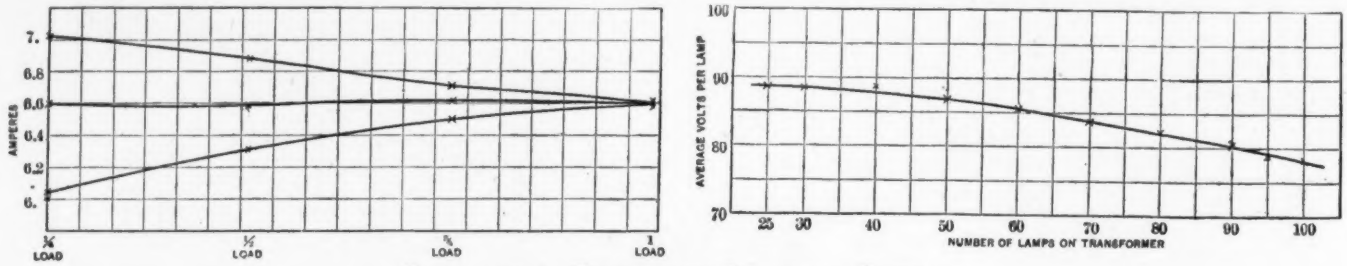
By bringing out the proper connections from the secondaries the total number of lights may be operated as a single circuit or operated in any desired number of multi-circuits in a manner similar to the well-known method employed on the Brush series dynamos of large capacity.

The larger sizes of this type of constant current transformers are always so arranged that the lights can be run on two circuits, or a single circuit, as may be desired. Owing to the high voltage of the enclosed arc lamp, the 100-light transformers usually operate two circuits connected upon the multi-circuit principle.

The transformer can be adjusted so as to give practically a constant current between one-third load and full load. As the properties of the transformer make it undesirable to run the transformer at less than one-third load, no attempt has been made to so construct the transformer that it would regulate under smaller loads. The regulation is sufficient, however, to prevent the current at no load rising to an extent that would endanger a single lamp if all others should be cut out. By adjusting the cam-shaped segment from which the counterbalancing weights are suspended, it is possible to regulate the transformer so that the current will increase or decrease as the number of lights is varied. The curves shown in Fig. 5 show the range of regulation that can be obtained by varying the adjustment of the cam supporting the regulating weights.

The early tests showed that when the transformers were adjusted to give a constant current through any desired range of load, the lamps would draw different lengths on the arcs depending on the number of lamps on the circuit. The voltage across the terminals of the individual lamps was approximately 10 volts higher at one-fourth load than at full load, although the current was the same in both cases. The results of a test of a 100-light transformer made to show this effect is given in Fig. 6. It has been found, however, that by varying the adjustment of the transformer it is possible to adjust it so that the voltage across the terminals of the individual lamps remains practically constant at various loads. If so adjusted, however, the current from the transformer is no longer constant but increases as the load increases. The adjustment that maintains a constant voltage across the terminals of the individual lamps seems the preferable one in those cases where the load of the transformer varies through a wide range. It is, however, of little practical importance in the operation of a street lighting circuit, as in that case the transformers are seldom operated in actual practice at less than 90 per cent. of full load. The curve, shown in Fig. 6 is obtained with the differential lamp. This is the type of lamp used in Hartford. Recently shunt lamps have been used. With shunt lamps the voltage of the lamp does not vary with the load provided the current remains constant.

Tests were made of the efficiency power factor and temperature rise of the transformers. The input and output of the transformers were measured with Weston wattmeters, ammeters and voltmeters and were calibrated before and after test with standard laboratory instruments.



FIGS. 5 AND 6.—TRANSFORMER REGULATION CURVES.

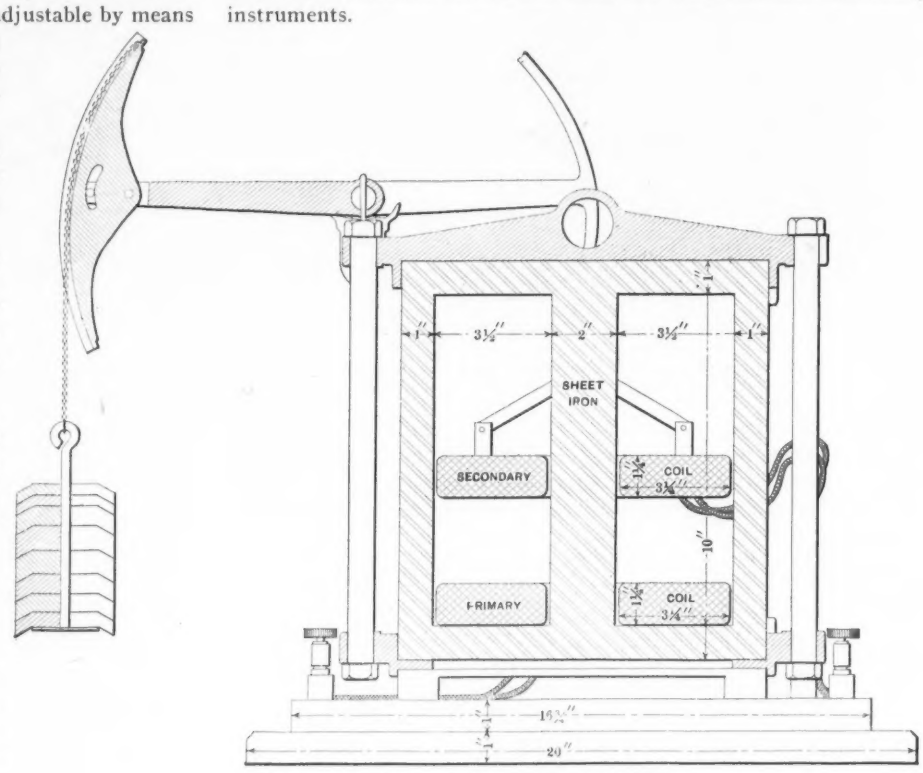


FIG. 7.—VERTICAL SECTION OF TRANSFORMER.

The averages of the results obtained from two 100-light transformers were as follows:

Load.	Efficiency.	Power Factor.
¼ Load	88.1	24%
½ "	92.3	44
¾ "	94.9	62
Full "	96.1	78

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The rise in temperature of the oil of the transformer measured at the top of the iron core, where it was highest, was 39° C. after a twenty-four hours' run.

Under the usual conditions of street lighting, the dynamos are run under at least 90 per cent. of full load and at this load the efficiency and power factor are very satisfactory. The power factor is about as high as that of the induction motor under the average load at which they are operated.

The low power factor at fractional loads, and the difficulty in maintaining the lamps at constant voltage when the current is constant at various loads combine to make the constant current transformer undesirable except when the conditions are such that it is possible to operate the transformer under a large part of its rated full load.

It has been found in practice, that the transformers can be maintained and operated successfully with very little attention. In Hartford five of the transformers are operated from two outlying substations. There is no attendant at either of the stations. The inspector of the district cuts on and off the lights at the proper time and visits the substations once during the night. Each transformer is equipped with a recording Bristol ammeter so that a complete record is made of the time of cutting on and off the circuits and of the time the inspector makes his nightly inspection, and of the working and adjustment of the transformer.

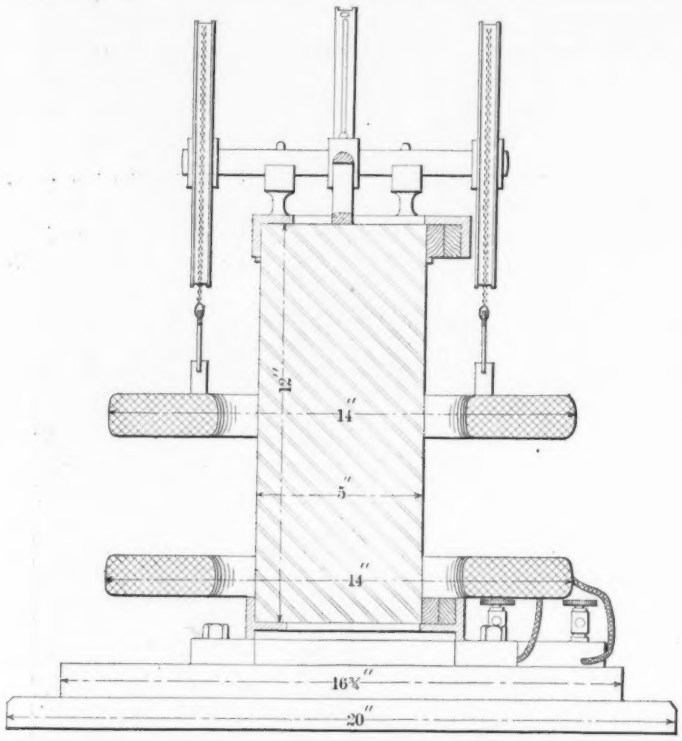

FIG. 8.—VERTICAL SECTION OF TRANSFORMER.

The primaries of the transformers are connected across the 2400-volt alternating current feeders. Although the voltage at the terminals of the primary of the transformer is subject to a variation of 5 per cent. during the street lighting hours, the current supplied to the series lighting circuits is practically constant. The current in the secondary is not affected by variations in the pressure at which current is supplied to the primary of the transformer.

At the meeting of the Institute Professor Robb illustrated the principle of the constant current transformer by means of a small working model belonging to the Jarvis Physical Laboratory, Trinity College.

The transformer had a capacity of about 1-kw and was used to operate twenty 100-volt 16-cp incandescent lamps connected in series. Switches were arranged so that the lamps could be turned off or on one at a time, and the motion of the movable coil of the transformer and the variation of current observed. When the number of lamps was reduced from 20 to 1 no variation in the brilliancy of the lamps was noticeable.

The dimensions and construction of this transformer is shown in Figs. 7, 8 and 9. It was manufactured by the General Electric Company.

As there is no alternating current in the meeting rooms of the Institute, the alternating current was obtained from a small rotary converter operated from the direct current in the building.

THE SERIES ALTERNATING ARC LAMP.

The lamps operated from the constant current transformer are of the carbon feed enclosed differential type. The alternating current used has a frequency of 60 cycles.

The lamps at the outset gave a good deal of trouble. A considerable percentage of the lamps failed to start. This trouble was soon found to be due to the burning out of the sliding contact by which electric connection is made with the upper carbon. A positive contact is now made by means of a very flexible wire made of fine strands. Since this change the operation of the lamps has been in all respects satisfactory. The records show that the lamps reported out and not starting are considerably less than when the street lighting was by direct-current series open-air arc lamps.

Up to the present no photometer tests of the candle power of the series alternating arc lamps have been made by me. The lamps used in Hartford consume at the transformer 400 watts per lamp, and replaced nominal 1200 candle power open-air direct-current arcs. The streets are undoubtedly better lighted with series enclosed arc lamps than they were formerly with the open-air arcs. The better diffusion of the light from the enclosed arc lamp, the steadiness of the light and its freedom from flickering, have much to do with the improvement in lighting and with the general

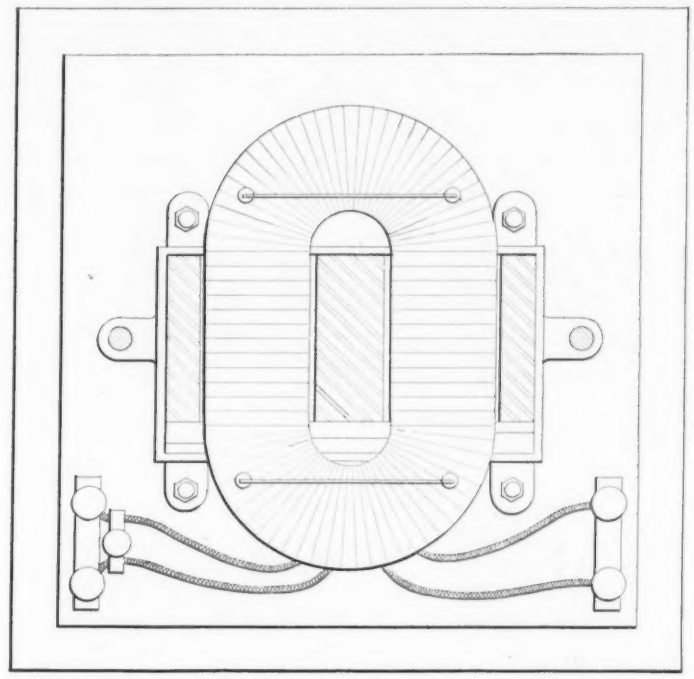

FIG. 9.—HORIZONTAL SECTION OF TRANSFORMER.

satisfaction it undoubtedly gives. From the results obtained at Hartford it would appear that the streets can be better lighted with 400-watt series alternating lights, than with an equal number of 1200 open-air direct-current arcs. If 2000 candle-power direct-current arcs were replaced by enclosed series alternating it would, in all probability, be necessary to increase the number of lamps in order to obtain equally good lighting.

Before the changes in the street lighting system the lamps were operated from Excelsior, Thomson-Houston and Brush series dynamos, belted from the line shaft. This was driven by a direct-connected synchronous motor. The power furnished the synchronous motor was 550 watts for each open-air arc lamp consuming 315 watts at the lamp. The power required under the local Hartford conditions for operating street lights has therefore been reduced by the change in the ratio of 500 to 400, or a little over 27 per cent.

Owing to the fact that the transformers are operated from outlying substations the wiring system has been very much simplified, and the cost of carrying current across the underground district considerably reduced. The maintenance of the transformers and the labor in looking after their operation is an almost negligible item. A very considerable saving is made over the maintenance and operation of the series direct-current dynamo. From experience extending now over a year it has become evident that the saving in operating expenses will pay for the entire cost of the

change in system within the first two years. At the expiration of this time there will be a very considerable annual saving, and at the same time the service rendered the city is very much bettet than it was under the old system.

The system of street lighting which will be found best for any given city depends largely upon the local conditions, but there are undoubtedly many cases where an investigation will show that the adoption of the constant-current transformer and the series alternating current arc lamp offers the greatest advantages.

West Ham, England, Central Station.

RECENTLY there has been completed at West Ham, England. a municipal central station which is of special interest from embodying the latest types of Ferranti generating apparatus and appliances. The single-phase alternating current system is employed with transformer substations. The West Ham street railways are being electrically equipped, and it is proposed to obtain the supply of electrical energy from the same station, mains running to electric railway substations where, presumably, the alternating current will be transformed to direct current by means of rotary converters. The generating room is 82 feet long, 42 feet wide and with a maximum height of 29 feet. The flooring is of rolled steel beams covered with York paving stones. All of the steam pipes, receivers, traps, etc., are carried beneath the floor, the space there having a height of 8 feet. The leads between the dynamos and switchboard also pass through this space.

There are at present installed three 200-kw Ferranti fly-wheel alternators, direct-connected to Ferranti steam engines, one of which units is shown in Fig. 1. There is also a 100-kw Ferranti set in course of erection.

The engines are all of the high-speed vertical cross-compound type, and rated to run at 250 r.p.m., the cylinders, including the heads, are steam-jacketed. The valves are of the balanced slide type, and are actuated by a specially designed link motion, which on the high-pressure side gives automatic control, while for the low-pressure cylinder the cutoff can be adjusted by hand as desired. The governors which control the high-pressure steam valves are of the high-speed spring-loaded type, and actuate a relay valve which di-

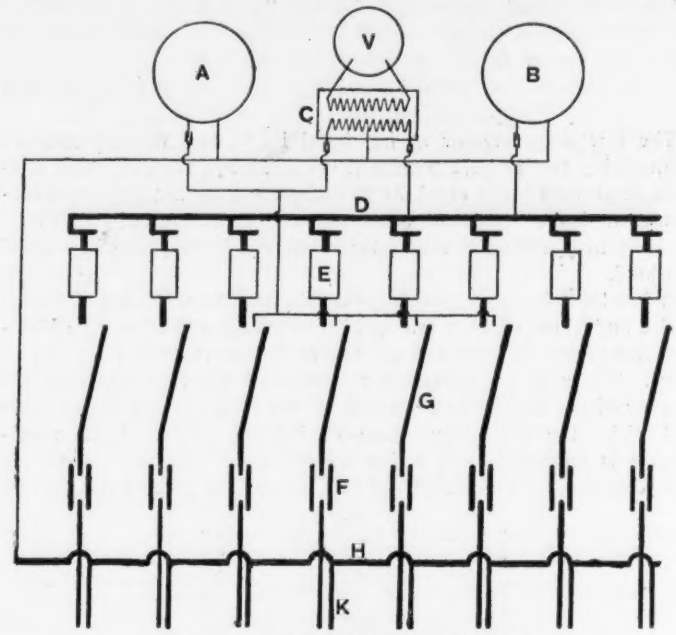

FIG. 2.—SWITCHBOARD CONNECTIONS.

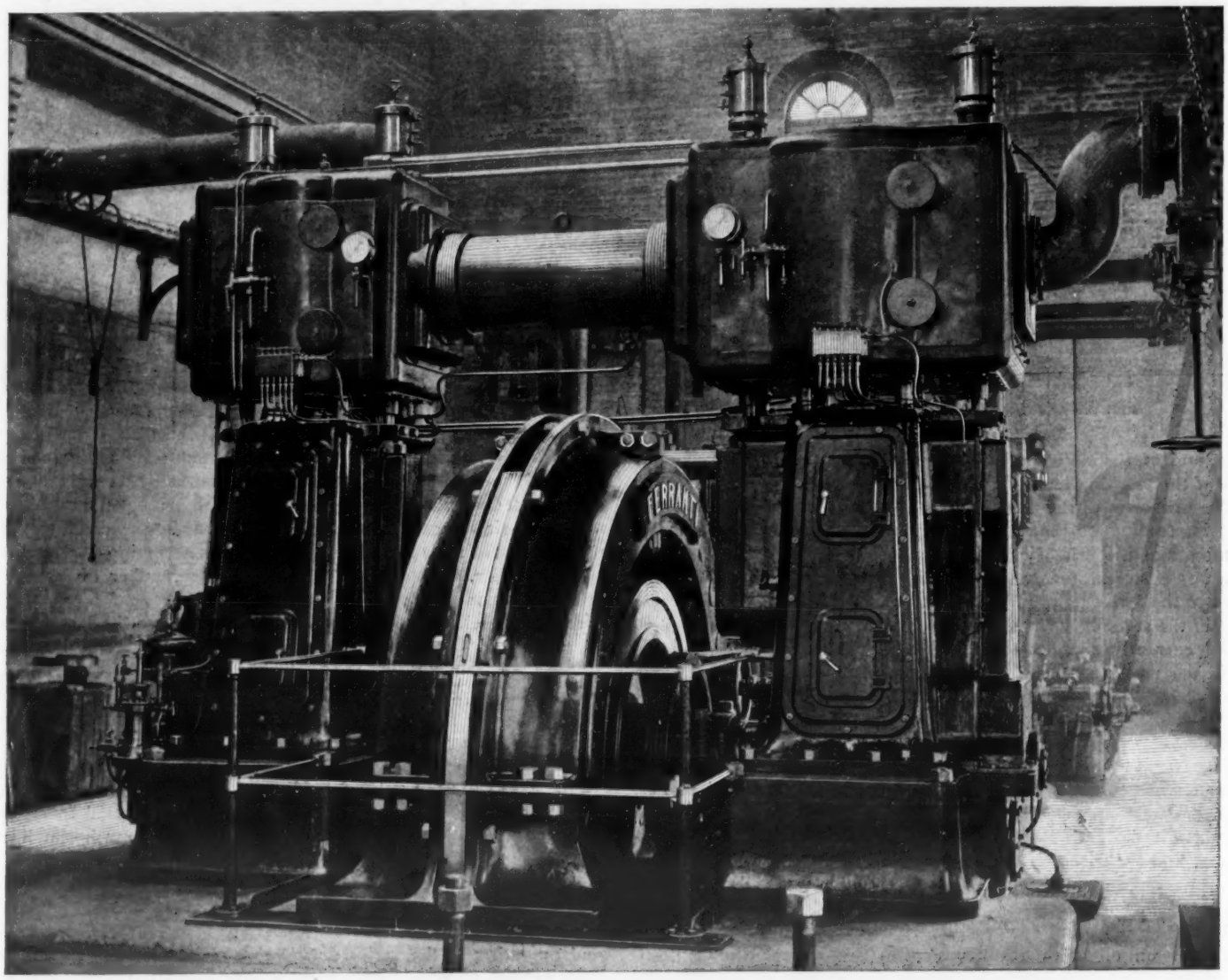

FIG. I.—FERRANTI GENERATING UNIT.

rectly controls the link motion. All the crank shaft bearings are of the spherical type, there being two to each crank shaft.

The generators consist of Ferranti disc alternators of the latest design and manufacture. It is interesting to note in connection with these alternators that from the time the West Ham plant was started, none has called for any attention, and the machines have in fact given no more trouble than if the engines were merely

The switchboard is constructed on the Ferranti single-pole system and is of the usual standard 150-ampere type used in a number of other English central stations. Fig. 2 shows the switchboard connections. A is a synchronous voltmeter, B a bus-bar voltmeter, C a synchronizer and V a voltmeter; D is the inner bus-bar and H the outer bus-bar, which is earthed at the machines; E is an ammeter, F an oil break fuse, with duplicate contacts, and G

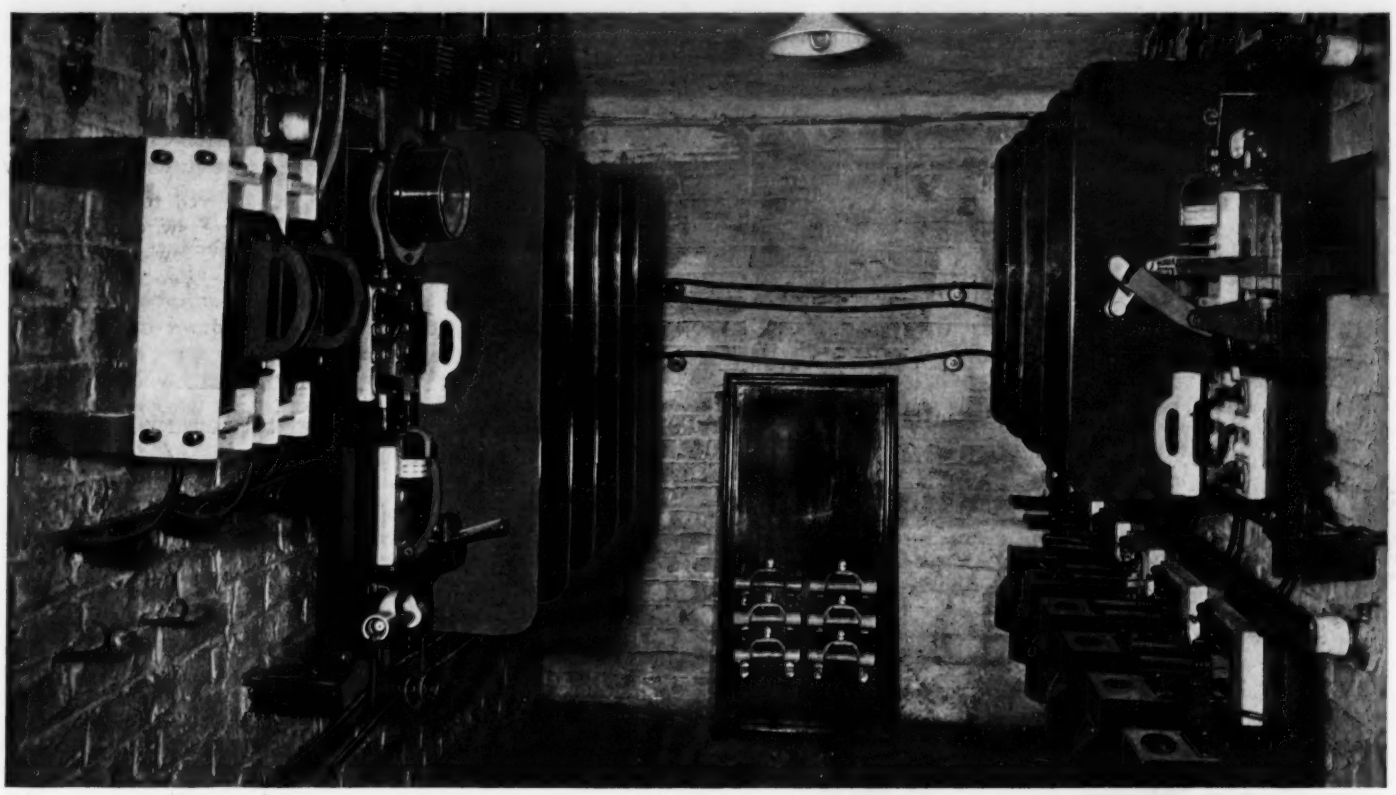

FIG. 3.—HIGH-PRESSURE ROOM OF MAIN DISTRIBUTING SUBSTATION.

driving plain fly-wheels. The 200-kw sets are of such solidity that it is found quite practicable to run them at 270 r.p.m. without any harmful effects, either from heating, regulation or with respect to noise, the dynamos running absolutely without sound at all loads.

The machines run in multiple most satisfactorily, being most easily thrown in parallel and running perfectly in step, the combined design of engine-alternator having been especially worked out to insure parallel running. On one occasion shortly after two of the largest sets had been erected, some temporary difficulty was experienced with the high-pressure valves during the running of the two sets. In order to supply current, the two engines were run on the low-pressure cylinder alone, live steam being admitted to these cylinders. With this arrangement it was found possible to run

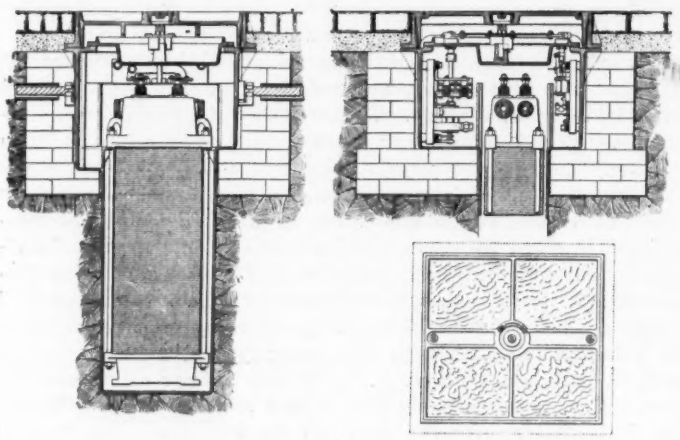

FIG. 4.—TYPE OF TRANSFORMER BOX.

the sets up to the rated capacity for the low-pressure cylinders, or 100-kw each.

Two Ferranti fly-wheel alternator sets of a similar type, but of 1500-kw capacity each, are shortly to be erected in an extension of the station.

switches; K are cables connecting to the machines and circuits. All of the connections are exposed on the front of the board, which, in fact, has no back connections whatever. The four-circuit panels each contain oil break fuses with duplicate contacts, high-tension spring brake switches and ammeters. The four dynamo panels are

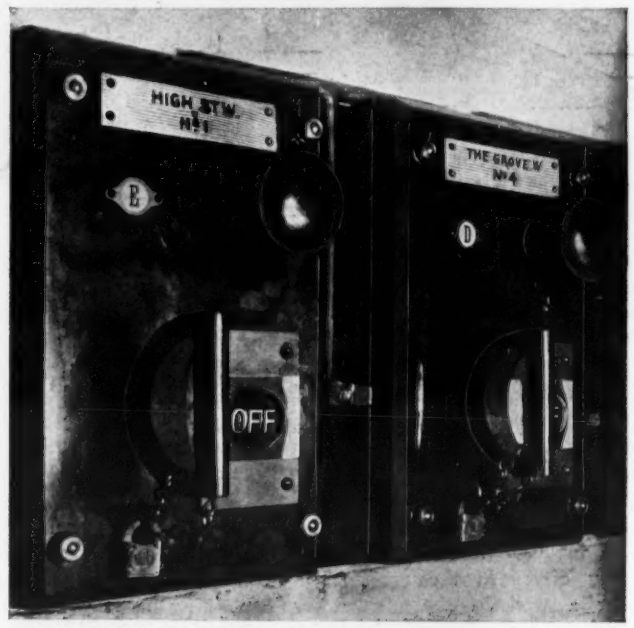

FIG. 5.—ARC CIRCUIT SWITCH.

similar in size and design to the circuit panels and have in addition a synchronizing contact in the switch panel, and a regulating box placed under and in a vertical line with the high-tension switch. On a slate at the top are mounted Kelvin type synchronizing and bus-bar volt-meters, and a Ferranti synchronizer, each instrument

being protected with a neat design of oil break fuse, which can be easily removed, thus disconnecting the instruments. A watt-hour meter board is mounted on the wall and contains four meters, absolute cutouts, transformers and fuses, each set being connected to the circuit cable. Fig. 6 shows one of the Ferranti high-pressure switches in "off" and "on" positions.

There are at present five substations and fifteen transformer boxes distributed over the area served. Two feeders are run from the central station to the main distributing chamber in the basement of the Town Hall at Stratford, and two others to a distributing chamber at the public hall in Canning Town. These chambers are each divided into two rooms, an outer chamber, in which the low-pressure apparatus is alone placed, and an inner and carefully locked chamber into which the high-pressure apparatus is installed.

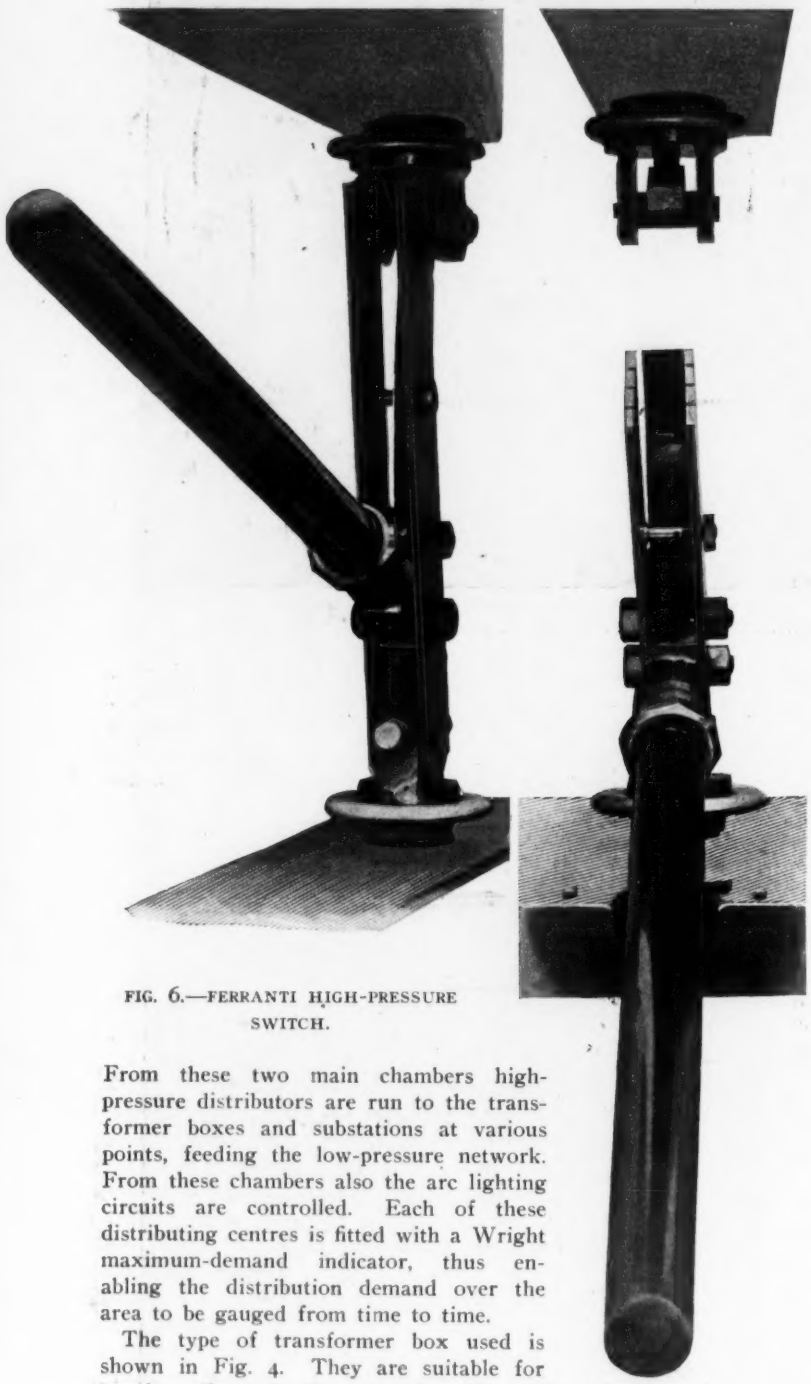

FIG. 6.—FERRANTI HIGH-PRESSURE SWITCH.

From these two main chambers high-pressure distributors are run to the transformer boxes and substations at various points, feeding the low-pressure network. From these chambers also the arc lighting circuits are controlled. Each of these distributing centres is fitted with a Wright maximum-demand indicator, thus enabling the distribution demand over the area to be gauged from time to time.

The type of transformer box used is shown in Fig. 4. They are suitable for burying direct in the ground, and consist of a cast-iron case having a well in the centre for containing a transformer of from 6 to 30-kw output, either for a frequency of 100 or 50. A double-pole low-tension fuse is mounted on each transformer, and the switch gear is contained in recesses on either side, the high and low-pressure portions being thus kept entirely distinct. On the high-pressure side are a double-pole switch and a single-pole fuse, provision being made for two concentric high-pressure feeder cables. On the low-pressure side are a double-pole main switch and four single-pole fuses, provision being made for four concentric feeder cables, two on either side of the case. Space is provided for the insertion of a Wright demand maximum indicator at each box, this instrument being found very useful in giving indication as to the maximum output at the various feeding points. Special arrangements are made for ventilating the box, and double covers are provided, the outer cover being lifted when the switches are required to be opened or closed. The entire system of cables, both for high and low-pressure, is of the concentric lead-covered and armored type, laid directly in the ground. To distinguish the high-pressure from the low-pressure mains, a copper wire is laid up with the armor of all the former.

About 88 arc lamps are now installed in the streets, these being of the enclosed type. They are arranged in series in special circuits from the high-tension supply, the circuits being controlled at two points—the main distributing chambers referred to in the paragraph on the substations. The high-pressure switches for these circuits, shown in Fig. 5, are operated from the low-pressure apartments in the main chamber, an indicator showing whether the switches are at the "on" or "off" position. In each arc lamp post there is a Brush transformer for stepping down from 2000 volts to the 83 volts required by the arc.

Warsaw, Poland, Central Station Plant—I.

DURING the early part of last year, the city of Warsaw, in Poland, decided to build a municipal electric plant to furnish current for lighting, power and traction purposes, and in order to embody in this plant the results of the most modern and economical engineering practice, the authorities employed Mr. W. H. Lindley to thoroughly investigate every detail which had any bearing on the proposition. The report submitted by this engineer has recently been issued in an elaborately printed form by the city authorities of Warsaw, and contains much valuable information on Continental engineering practice, the arguments on which Mr. Lindley bases his final conclusions, and a description of the plant as designed by him and accepted by the city.

The report is divided into seven main chapters, dealing respectively with General Arguments and the System, Alternative Sites and Plans for the Central Station, Description of the Station, Description of the Distributing System, Operation of the Railways, First and Second Extensions, Building and Operating Costs and Earning Capacity. This matter fills 72 pages, and is accompanied by over twenty maps, illustrations, several of which are printed in colors, numerous tables and an appendix of 23 pages.

In the first chapter we find a general statement of the problem, namely, the generation of current for public and private lighting of buildings, public and private power purposes, public street lighting, and the operation of street cars. The current for these purposes may be produced either by (1) direct current; (2) direct current with accumulator substations by charging the accumulators directly from the central station; (3) direct current distribution from acmulators fed by rotary transformers, which latter are supplied from alternating current central stations; (4) alternating current, either single or multiphase (Drehstrom) and the use of transformers.

Then follows a discussion of the advantages of the electric current for power and lighting purposes and the growing population and needs of the City of Warsaw. The territory to be supplied with current measures 3½ miles in one direction, and from 4 to 5 miles in the other. To supply so large a territory with direct current is out of the question, as is also the building of several small stations on account of the cost of real estate, the difficulty of locating near condensing water and the cost of coal transportation. Besides the alternating current, the generation of a high-tension alternating current which is transformed into continuous current at substations and is then distributed directly over the system or by means of accumulators, deserves consideration. The latter system has numerous advantages, such as the low e. m. f., the accumulator acting as a reserve, and makes the supply independent of the continuous operation of the machines for any short periods, the more regular load on the machines in the station insures a higher efficiency, and, therefore, more economical operation.

Mr. Lindley then proceeds to discuss the relative advantages of direct and alternating currents in the following manner:

(1) In regard to incandescent lighting the two kinds of current are equally well applicable.

(2) In regard to supplying motors, neither one has a decided ad-

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vantage over the other. It is true that for certain work such as elevators, the direct current motor has, on account of its large starting torque advantages over the single phase alternating current motor; on the other hand, the latter possesses the advantage of not having a commutator nor brushes and the absence of all regulating devices with the exception of a starting device. These advantages which are evident in a large number of cases more than overbalance its few disadvantages when the motor is to be used for special purposes.

(3) In regard to arc lighting the alternating current is somewhat at a disadvantage, i. e., the same amount of energy gives more light in the direct current arc than the alternating one; a part of this saving, however, is overbalanced by the consumption of energy by the extra resistance in the direct current arc lamp. The alternating current furthermore has the advantage of enabling one by means of small transformers to cut single lamps into and out of the circuit, and insures the more even distribution of the light, which, however, is no disadvantage for interior lighting of halls, stores, etc.

The two systems when compared in regard to their utility for lighting and power purposes may, therefore, be said to be on an equal basis. In regard to the use for railway purposes, it may be considered as immaterial whether in the station to be erected at present, direct or alternating current is generated. For the operation of the railway, a direct current of from 500 to 600 volts' pressure is required; the simultaneous supply of current for lighting and traction purposes at this pressure is out of consideration.

It is therefore out of the question to generate continuous current and distribute the same from substations and use it simultaneously for lighting and railway supply. Separate substations or special machines generating a 500 to 600-volt direct current would have to be installed for supplying the street cars, and this can be done equally well whether the rest of the system is supplied by means of direct current substations or directly from the central station by means of the alternating current and transformers.

In other words the railway supply does not enter into the question of choice of current, as in either one of the cases proposed provision has to be made for the generation of alternating currents.

The conditions present in Warsaw, however, offer the following well-founded objections to the choice of direct current distribution from substations: (1) The sections to be supplied with current are widely distributed. The choice of the direct-current system would, therefore, necessitate the building of a number of substations, which is impractical on account of the great expense involved. (2) The constant increase in population would necessitate the building of new substations from time to time. (3) The large number of substations, each one of which would require 20 or more feeders, would necessitate the constant tearing up of streets, which is costly, disadvantageous and disturbing to traffic. (4) If it be desired at any time to connect a large power load into the circuit it is necessary to lay a new feeder of large crosssection and at a pressure of from 200 to 240 volts, an influence of this load on the lights in that section cannot be avoided.

The alternating current system, on the other hand, has the following advantages:

(1) It is a simple matter to meet growing demands for current by the laying of a small primary cable or a moderately heavy feeder. (2) The cable network once completed will be sufficient to supply the demand in the near future, as several main feeders can be laid to supply suburban districts at the time the network is originally planned, and the cost of this is permissible on account of the small cross-section of the feeders. (3) The high-pressure and small drop calculated to take place on the feeders, gives to each section a high efficiency and motors of considerable size may be added at any time without the laying of extra feeders.

In view of all these facts and the conditions governing this particular problem, Mr. Lindley recommends the adoption of the alternating current. This is to be generated at high pressure at the central station, distributed by means of feeders throughout the city, transformed into low-tension alternating current by means of transformers, and in this form it is delivered to the consumer.

It is true that accumulators cannot be charged by the alternating current, but repeated calculations have shown that in cases similar to this one, the costly construction and operation of a substation, the purchase of real estate, the repairs on the accumulators, the losses incurred in the transformation, the cost of the conductors, etc., overbalance the saving expected from the building of a smaller central station and its more favorable operation as well as other advantages of the direct current.

There is also no advantage to be gained from a financial standpoint by investing the initial capital in transformers and accumulators instead of generators, and investing it in steam engines and alternators has by far the advantage. Definite data are at hand in regard to the depreciation of such machinery, while in regard to accumulators very little reliable information can be obtained. Besides, the steam engine and alternator, as well as the boiler and accessions, can always serve in various capacities, and can supply current for any kind of service, while accumulators can only be used for the reception and delivery of electrical energy, and represents, one might say, a dead expense.

Mr. Lindley, however, does not wish to imply by this that for certain purposes for which the distribution of current by means of accumulators has a definite value—for instance, for the illumination of theatres and places of amusement, of large groups of public buildings, and in the operation of railways—the employment of the same in connection with alternating current distribution and rotary transformers would not be advantageous. Accumulators would further be of value in an alternating current plant by insuring a more uniform and efficient load on the machinery by using at night for the charging of the accumulators when the other load is comparatively light.

In regard to the certainty of continuous current supply, it is only necessary to properly subdivide the units. The distributing system may be protected against disturbances by supplying each feeding point from several directions and by means of a number of feeders and cables, all of which are entirely independent. In case any link of such a system is disturbed, it may be supplied by other branches.

Mr. Lindley then discusses in several paragraphs the advantages to consumers in obtaining his current from the central station in preference to installing an isolated plant within the city limits. To support this, however, the projected installation must be so planned as to insure constant and reliable service, and for this reason he has decided to submit plans for a high-tension alternating current plant. It is proposed to generate this current at the central station at a pressure of from 4000 to 5000 volts. It has been the custom during the past few years to use a voltage of from 2000 to 2200 volts, and at Frankfort Mr. Lindley employed a pressure of 3000 volts. This was chosen on account of the simpler regulation which is possible when the drop of pressure on the feeders and distributing circuit is calculated to be very small. At Frankfort the permissible drop on the main feeders is 4 per cent., the primary circuit 1 per cent., a total of 5 per cent. drop from the central station to the transformer. The higher pressure further permits a greater equalization of the network so that an influence of sudden demand for current is hardly noticeable on the line. The employment of 3000 volts has proved very satisfactory at Frankfort as well as Budapest.

In view of his experiences, Mr. Lindley is convinced that there is no difficulty in supplying a city with alternating current at a pressure of from 4000 to 5000 volts. At the pressure of 4000 volts the drop on the main feeders is calculated to be 2 per cent., and on the primary circuits ½ per cent., or a total of 2½ per cent., one-half of that permitted at Frankfort. This drop is so small that the regulation of the separate main feeders is entirely superfluous. It is clear that in the most unfavorable case, that is when one branch of the system is fully loaded and the other without any load and the pressure regulated to the mean value, then this deviation from the normal pressure at the respective transformers can only be 1 per cent., which is within the allowable limit, and is a case which very seldom occurs in practice.

The next question discussed by Mr. Lindley is the one relating to the ultimate capacity of the station. This is influenced by the growth of the city and the resultant demand for current. The growth of the electrical industry and the improvement of apparatus must also be taken into consideration, and in view of this, it might be stated that in England the enlargement and improvement of plants has reduced the price of electric current for lighting purposes to such an extent that it is only two-thirds or one-half, and sometimes even less, of the price charged for current on the continent.

In Mr. Lindley's opinion the demand for electrical energy for lighting purposes in the City of Warsaw would probably not exceed for the next few years from 20,000 to 25,000 incandescent lamps burning at one and the same time, and will for an even greater length of time probably not exceed 30,000 to 40,000 lamps. The lighting of public streets will require from 250 to 300-kw, which may be expected to reach 400 to 500-kw in the distant future. The demand for current operation of motors in view of the existing conditions is expected to reach 400-kw in the near future and 600-kw when further developments have taken place. The operation of the railway,

whether it is done directly by means of direct current with overhead or underground trolley or by means of accumulators or even by a mixed system, that is trolley and accumulators, will probably require 1000-kw. The station, therefore, should be built to furnish 2000-kw without including railway supply and 3000-kw including it. Both figures probably will have to be increased by 1000-kw in the near future. Considering further the growth of the city and its industries and the experience of other cities, it might be well to contemplate a final equipment furnishing 12,000-kw and a maximum output of from 10,000 to 11,000-kw. At first, however, it would only be necessary to install sufficient machinery to generate 3000-kw.

In regard to the size of the units, Mr. Lindley believes that it is not a good plan to subdivide the same too much, and that the subdivision depends on the minimum demand for current at any time, the necessary reserve and finally on the size of the plant and the number of machines desired. He proposes to divide the complete installation into 12 units of 1000-kw each, 4 units of 1000-kw each, and 4 more of 2000-kw each, and to install the 4 smaller ones at the outset.

The last proposition divides the total capacity among eight units. A unit of 1000 or 2000-kw, that is, one-half or one-sixth of the total series as a reserve. The advantage of seven machines instead of 11 is also an advantage, as they can be connected together with greater rapidity. The completed station, therefore, will be equipped with either 12 machines of from 1200 to 1500-hp or four machines of from 2400 to 3000-hp, with the necessary oilers and chimneys and a coal bin of sufficient size to hold coal for two or three months' supply.

This concludes Mr. Lindley's main arguments, which are given in great detail and clearness.

In the next chapter of his report he considers the various locations, as to their availability for a central station. He emphasizes the importance of combining the electric plant with some existing municipal enterprise, so as to be benefited by the reduction of operating expenses. Some of the enterprises which he mentions are the filtering, cooling and pumping stations, and the sewage disposal plant. After a thorough discussion of the various sites, Mr. Lindley recommends the building of the station on the Dobra, near the old waterworks, which site possesses numerous advantages. It is located near the point of maximum consumption, and has a central location in regard to the entire territory to be supplied. The water for condensation can be obtained directly from the Weichsel. Less favorable, however, is the manner of obtaining the coal supply, as it is impossible to connect a siding to the railroad at that point, and this, of course, will increase the operating expenses. Besides a portion of the feeders for a small distance lies below high-water, and the territory in which they are buried is frequently flooded. The foundation conditions are also not very favorable. After considering every other site, however, and carefully weighing the advantages and disadvantages of each, Mr. Lindley finally concludes to recommend the Dobra site, which has the most central location, can be utilized with the least difficulties, and possesses a large number of advantages. His plans, which are worked out with reference to this site are, on the other hand, applicable for any of the other sites, with only slight modifications. The final reasons given for the adoption of the Dobra site are as follows: It offers the most favorable solution of the problem from a financial standpoint; it does not necessitate a greater pressure than 4000-volts; the increased cost of operation due to the difficulty of obtaining coal can be reduced in the near future by the building of a railroad siding; the station can be worked in unison with the pumping station supplying water to the lower city, and will thus solve one of the most important sanitary and industrial problems of the city. The entire project has been carefully worked out by the engineer, and is accompanied by a large number of illustrations, to which we will refer later.

Electric Railway Work in Vera Cruz, Mexico.

Vice Consul Pages, of Vera Cruz, states that the Empresa del Ferro-Carril Urbano de Vera Cruz has been acquired by an English syndicate and that the capital is to be $250,000. He says: The road, when reconstructed, is expected to be a well-equipped, modern electric railway, furnishing ample transit facilities for Vera Cruz. In their management, the roads are conservative, and even the least profitable are supposed to be on a paying basis. These roads have hiterto obtained their equipment and supplies chiefly from the United States.

German Electric Automobiles.

The current number of Consular Reports contains a report by Consul General Frank H. Mason, of Berlin, on the International Motor Carriage Exposition recently held at Berlin. He says that as one of the results of the exposition, large sales of automobiles have been made, some of the types having been sold as many as twenty times over for future delivery. It is also stated that for

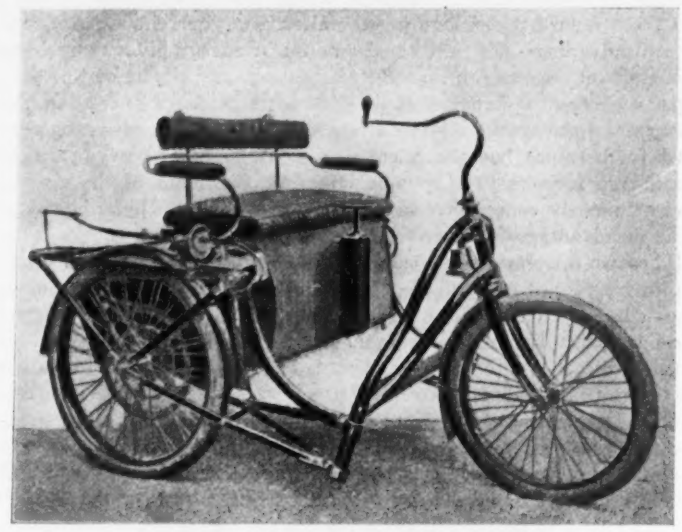


FIG. 1.—PRIMARY BATTERY AUTOMOBILE.

town and city use the electrical carriage had the preference among purchasers, the reasons being that it is more easily handled, is self-starting, free from smell and can be run at wide ranges of speed without the use of multiple gears. As they are also rated for forty miles without recharging, this is quite sufficient for ordinary city, park and suburban driving. Another advantage is that the vehicle can be managed after little practice by an amateur without the presence and help of a skilled driver.

Among the novelties exhibited was a two-seated tricycle (Fig. 1) manufactured by A. Krieger, of Berlin, and named the "Electra." The frame is of steel tubes. The front guide wheel is moved by a handle in reach of the driver, the rear axle is discarded and the driving wheels are hung independently on each side. This gives full space beneath the seat for carrying the motor and battery.

The battery consists of primary cells giving 2.5 volts per cell. The battery box is about 2 feet in length and 18 inches in breadth and depth. The negative electrodes are ordinary zinc plates, and the positive plates are of peroxide of lead impregnated with a mass

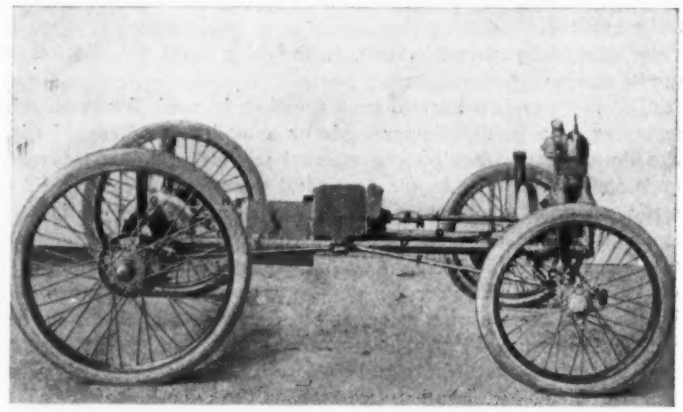


FIG. 2.—COMBINED ELECTRIC AND GASOLINE AUTOMOBILE.

of salt which is readily dissolved by water. The electrodes being in position, the water is poured in, the acid salt is dissolved, and the battery is at once ready for use. When the positive plates are exhausted, they may be removed, the spent solution discharged, fresh plates inserted and water again poured in.

The vehicle with its cells filled and carrying fresh electrodes for a run of about 40 miles weighs only 378 pounds. The inventor claims for it a radius of 62 miles with extra plates, that can be

readily carried in space provided in the vehicle. The bed of the vehicle is so constructed that the battery and motor with the supply of extra plates, rest on a special set of springs, and thus do not communicate any oscillatory motion to the seat. The controller is managed by a crank set vertically in front of the centre of the seat.

Consul General Mason states that this vehicle was the object of special interest during the exposition. When it was tested, however, before the committee of award, an accident happened "by which the positive electrodes being overcharged with acid developed an excessive current which became for the moment difficult to control, so that the machine made an unfortunate impression at a critical moment and received only a bronze medal."

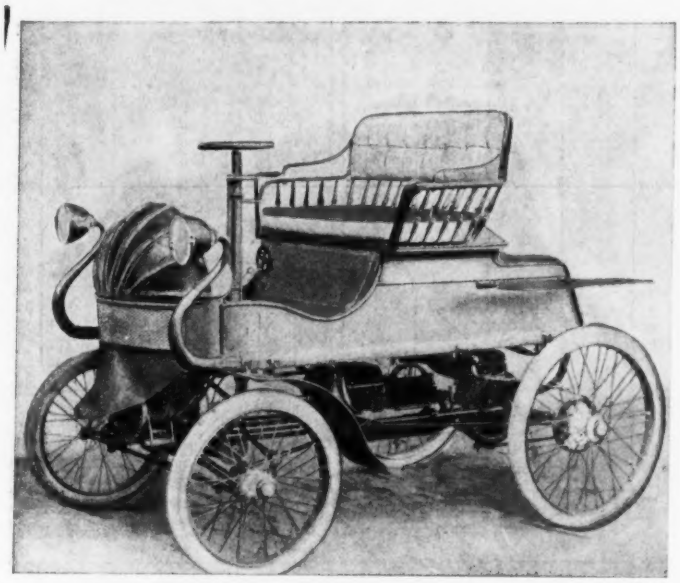


FIG. 3.—DOUBLE MOTOR CARRIAGE.

The second novelty was a combined electric and gasoline automobile (Figs. 2 and 3), from the works of the Pieper Company, at Liege, Belgium. The wheels and tubular frame are of the ordinary type except that the front and rear axle are connected by two strong rigid steel braces on which rest the electric motor, accumulator and the device for regulating the speed. The gasoline engine rests on springs over the front of the axle and turns the main shaft, which extends backward through the motor and connects by bevel gearing with the rear axle carrying the driving wheels. There is thus a benzine engine and an electric motor geared to the same driving

FIG. 4.—AUTOMOBILE DRIVEN FROM FRONT AXLE.

shaft, and both can be worked at the same time, and either thrown off and the other left in action at the will of the driver.

The accumulator can be charged in the usual manner with current from an ordinary lighting plant, and when used in cities the vehicle would be run as an electric automobile, with all the advantages of that system. On a long journey, however, or when remote from an electric supply service, the gasoline engine is not only sufficient to propel the carriage, but by running the motor as a dynamo, serves to recharge the accumulator.

In the carriage on exhibition the electric motor is of 2½-hp, the accumulator weighs 125 pounds and the gasoline engine develops 3 to 3½-hp. When both are in action in climbing a steep hill or traversing a heavy road, the driver has thus 6-hp at command. On a level, easy road and whenever the load falls below the power exerted by the gasoline engine, the electric motor changes automatically to a dynamo, and the surplus power is converted into current. In running down hill or in stopping the carriage, the momentum of the vehicle is taken care of by the electric motor acting as a generator, electrical energy being stored in the accumulator. Thus in an ordinary journey, the latter may be kept constantly charged, or if exhausted, can readily be recharged by running the motor as a generator when the carriage is at rest. A meter in front

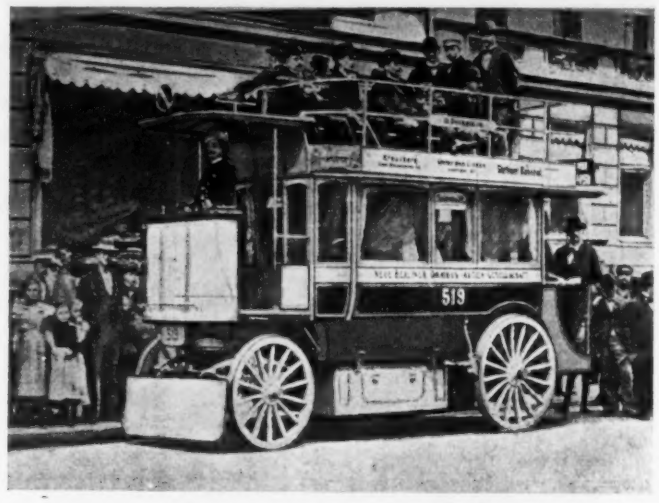


FIG. 5.—ELECTRICAL OMNIBUS.

of the driver indicates the state of the accumulator. The change from motor to generator and conversely is automatic, not requiring any attention from the driver.

The working parts are all hermetically sheathed and notwithstanding the presence of two motors, the carriage is lighter, both in fact and appearance, than most electric vehicles. None of the machinery is carried beneath the seat, all being borne by the running gear above, and the weight of the gasoline engine is more than compensated for by the comparative lightness and small size of the accumulator. This vehicle is sold at retail in the form of an open double-seated wagon, known in America as a "runabout," for $1190. Consul General Mason adds that so great was the demand that no delivery of the vehicle was guaranteed under less than six months.

Fig. 4, from our contemporary, *Elektrotechnischer Anzeiger,* shows an automobile seating seven persons, exhibited by the Aktiengesellschaft Elektricitätswerke, and interesting from its peculiar guiding arrangement.

As is well known, vehicles drawn by animals have the rear axle rigidly connected to the wagon, while the front axle is connected to the vehicle by means of a bolt fastened to the centre of the axle, and about which the axle pivots. In the automobile here illustrated the motor is not placed upon the rear axle, as usual, but upon the pivoted front axle. There are two motors, each of which drives independently of the other one of the wheels by a double reduction gearing, so that the speed of the two wheels may be varied when turning around a curve.

The principle of the bicycle is applied in the use of a handle-bar directly connected with the pivoted front axle. By this means the greatest possible mobility is secured, and the driver can see at any moment in which direction the wheels point.

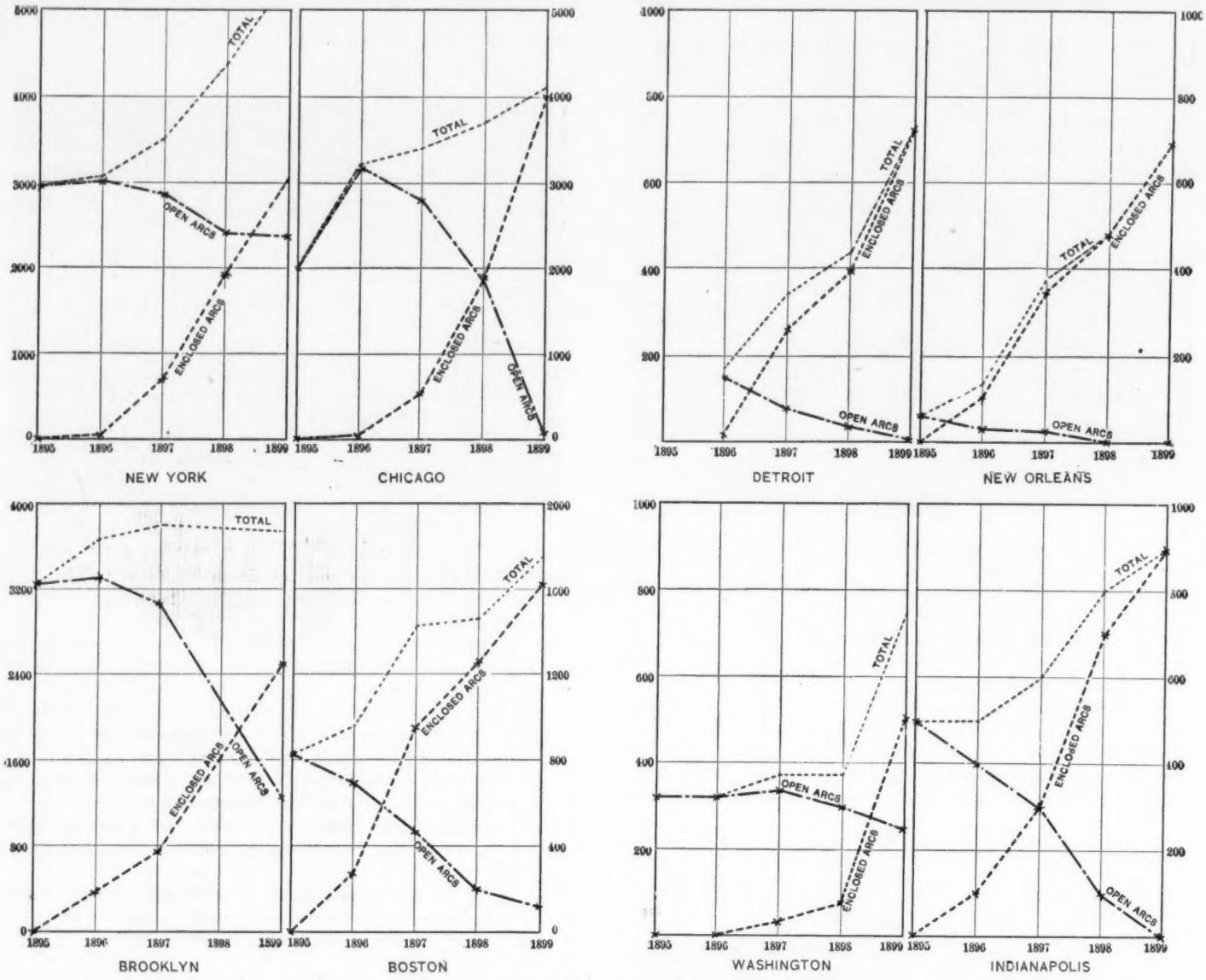
Fig. 5 shows one of the electric omnibuses that have been built by the Union Electrical Company, of Berlin, and are now running in that city. Each holds 28 persons, and the seats are always filled. They are equipped with two motors of a nominal 4-hp and carry their batteries in the box seen between the front and rear axles. They are described as being very popular, and as competing on more than equal terms with the old horse busses and even with the trolley cars. They run on Friedrichstrasse and other well-known thoroughfares.

Enclosed Arc Lamp Statistics.

RECORDS OF THIRTY-SIX CENTRAL STATIONS.

By L. B. Marks.

In an article on "Progress of the Enclosed Arc Lamp," published in the *Electrical World* of June 5, 1897, the writer submitted statistics showing the number of open and of enclosed arc lamps in use up to May, 1897, on the circuits of the New York, Boston and by the Brooklyn Edison Companies respectively. Through the courtesy of these companies their records up to April of the present year are now given. These statistics are supplemented herein by data kindly furnished for publication by a large number of companies* holding membership in the Association of Edison Illuminating Companies.



CURVES SHOWING RELATIVE USE OF OPEN AND ENCLOSED ARCS.

This list includes the majority of the companies holding membership in the Association. Data were received from six other companies, but were too meagre to warrant publication in this table.

The records for 1895, 1896, 1897 and 1898, except where otherwise indicated, refer to the number of arc lamps in commercial use on May 1 of each year; for 1899, on April 1. Most of the arcs installed by these companies are operated on direct current constant potential circuits. In some cases a separate service is maintained for constant current high tension lamps; such lamps or circuits are referred to in the footnotes simply as "series."

The relative use of the two types of lamps by eight lighting companies is graphically represented in the accompanying figures. The progress of the enclosed arc lamp is notably marked in the cases cited, which include New York, Chicago, Brooklyn, Boston, Detroit, New Orleans, Washington and Indianapolis.

In general it will be noted from the foregoing:

1. That the year 1895 marks a notable turning point in arc lamp practice, brought about by the introduction of the enclosed arc lamp.

2. That the use of the open arc type of lamp is rapidly declining.

3. That the enclosed arc is superseding the open and also greatly extending the arc lamp field. This is borne out by the fact.

4. That the total number of arc lamps in use each year shows a remarkable increase over the preceding year.

Referring to the table, the statistics show that the progress of the enclosed arc was relatively slow up to 1896. The number of open arcs in use that year was greater than in 1895, but dropped rapidly in 1897, and more rapidly in 1898 and 1899. The records for 32 cities in 1896 and 1899 respectively are as follows:

Number of open arc lamps in use 1896	23,605
Number of enclosed arc lamps in use 1896	1203
Total	24,808

*The companies from whom statistics were obtained are as follows: Appleton Electric Light & Power Company, Appleton, Wis.; Georgia Electric Light Company, Atlanta, Ga.; Edison Electric Illuminating Company, Boston, Mass.; Edison Electric Illuminating Company, Brockton, Mass.; Edison Electric Illuminating Company, Brooklyn, N. Y.; Buffalo General Electric Company, Buffalo, N. Y.; Canton Light, Heat & Power Company, Canton, Ohio; Chicago Edison Company, Chicago, Ill.; Cincinnatl Edison Company, Cincinnati, Ohio; Columbus Edison Company, Columbus, Ohio; Edison Electric Illuminating Company, Cumberland, Md.; Edison Illuminating Company, Detroit, Mich.; Elgin City Railway Company, Elgin, Ill.; Edison Electric Light & Power Company, Erie, Pa.; Edison Light Company, Grand Rapids, Mich.; Indianapolis Light & Power Company, Indianapolis, Ind.; Jackson Light & Power Company, Jackson, Mich.; Edison Light & Power Company, La Crosse, Wis.; Minneapolis General Electric Company, Minneapolis, Minn.; Edison Electric Company, New Orleans, La.; Edison Electric Illuminating Company, New York, N. Y.; Edison Electric Illuminating Company, Paterson, N. J.; Piqua Electric Company, Piqua, Ohio; Metropolitan Electric Company, Reading, Pa.; Rochester Gas & Electric Company, Rochester, N. Y.; Missouri Edison Electric Company, St. Louis, Mo.; St. Paul Gas Light Company, St. Paul, Minn.; San Francisco Gas & Electric Company, San Francisco, Cal.; Edison Sault Electric Company, Sault Ste. Marie, Mich.; Scranton Illuminating Heat & Power Company, Scranton, Pa.; Washington Water Power Company, Spokane, Wash.; Electric Light & Power Company, of Syracuse, Syracuse, N. Y.; Toledo Consolidated Electric Company, Toledo, Ohio; U. S. Electric Lighting Company, Washington, D. C.; Waterbury Traction Company, Waterbury, Conn., and Wilmington City Electric Company, Wilmington, Del.

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Number of open arc lamps in use 1899..... 16,010
Number of enclosed arc lamps in use 1899..... 20,848

Total 36,858

Decrease in three years, open arcs.....over 32 per cent
Increase in three years, enclosed arcs.....over 1600 per cent
Increase in three years, total arcs.....almost 50 per cent

NUMBER OF ENCLOSED AND OPEN ARC LAMPS IN USE IN 1895, 1896, 1897, 1898 AND 1899 ON CIRCUITS OF THIRTY-SIX CENTRAL STATIONS.

		1895.	1896.	1897.	1898.	1899.
ppleton, Wis.....	Open arcs	18	16	15	26	13
	Enclosed arcs..	0	0	26	32	53
Atlanta, G.	Open " ..	198	314	374	375	99
	Enclosed " ..	0	0	0	4	347
Boston Mass.....	Open " ..	827	695	471	197	139
	Enclosed " ..	0	263	957	1258	1626
Brockton, Mass.....	Open " ..	74	70	78	85	83
	Enclosed " ..	0	0	0	4	80
Brooklyn, N. Y.[1]	Open " ..	3237	3294	3058	....	1244(c)
	Enclosed " ..	0	377	733	...	2489
Buffalo, N. Y.[2].	Open* " ..	1500	1650	2000	2500	3000
	Enclosed* " ..	0	0	220	400	560
Canton, O.	Open " ..	95	121	118	117	124
	Enclosed " ..	0	0	0	0	10
Chicago Ill.[3].....	Open " ..	2018	3210	2809	1818	49
	Enclosed " ..	0	34	592	1890	4087
Cincinnati, O.[3].....	Open " ..	275	280	180	120	163
	Enclosed " ..	0	0	82	201	223(b)
Columbus, O.....	Open " ..	33	44	30	22	5
	Enclosed " ..	0	0	176	242	335
Cumberland, Md.....	Open* " ..	157	161	161	152	130
	Enclosed* " ..	10	20	35	59	85
Detroit, Mich....	Open " ..	....	150*	80	40	10(b)
	Enclosed " ..	....	20*	261	390	726(b)
Elgin, Ill....	Open " ..	100	....	....	....	32
	Enclosed " ..	0	....	....	....	150
Erie, Pa.	Open " ..	....	....	600*	225	190(b)
	Enclosed " ..	....	....	25*	73	100(b)
Grand Rapids, Mich.[4]..	Open " ..	180	225	250	210	150(b)
	Enclosed " ..	0	0	2	50	500b)
Indianapolis, Ind.....	Open " ..	500	400	300	100	0
	Enclosed " ..	0	100	300	700	900
Jackson Mich.....	Open " ..	60	60	60	25	11
	Enclosed " ..	0	0	0	50	175
La Crosse Wis.....	Open " ..	62	94	84	53	48
	Enclosed " ..	1	1	6	10	23
Minneapolis, Minn.....	Open " ..	244	310	342	310	237
	Enclosed " ..	0	0	0	70	408
New Orleans, La.[5].....	Open " ..	65	30	26	0	0
	Enclosed " ..	0	101	350	479	692
New York, N. Y.	Open " ..	2964	3033	2831	2425	2386
	Enclosed " ..	....	25*	700*	1959	3081
Paterson N. J..	Open " ..	175	200	245	395	254
	Enclosed " ..	0	0	5	150	366
Piqua, O.	Open " ..	36	36	41	52	55
	Enclosed " ..	0	0	0	0	0
Reading, Pa.[2].....	Open* " ..	300	350	400	450	600
	Enclosed* " ..	15	140	160	250	375
Rochester N. Y..... ...	Open " ..	650	....	....	....	767
	Enclosed " ..	0	....	....	....	669
St Louis, Mo.[6].....	Open " ..	4282*	4282*	4282*	4282*	3366
	Enclosed " ..	0	0	0	0	946
St Paul, Minn.[2].. ...	Open " ..	....	416(a)	526.a)	520(a)	695(a)
	Enclosed " ..	0	0	0	18(a)	114(b)
San Francisco, Cal.[6]....	Open " ..	1906	1831	1902	1497	1493
	Enclosed " ..	0	62	93	107	332
Sault Ste. Marie, Mich.	Open " ..	...	....	....	....	104
	Enclosed " ..	0	14	39	46	60
Scranton, Pa.[7].....	Open " ..	800	800	0	0	0
	Enclosed* " ..	5	60(d)	0	....	270 b)
Spokane, Wash....	Open " ..	193	225	361	468	463
	Enclosed " ..	0	0	0	23	201
Syracuse, N. Y.....	Open " ..	162	147	133	166	111
	Enclosed " ..	0	0	0	12*	557
Toledo, O.[8]....	Open " ..	341	305	281	188	165
	Enclosed " ..	0	0	....	....	325
Washington, D. C.[9]....	Open " ..	320	320	340	300	250
	Enclosed* " ..	0	0	30	75	508
Waterbury, Conn	Open " ..	137	150	178	134	138
	Enclosed " ..	0	0	11	75	167
Wilmington, Del.[2].....	Open " ..	321	386	464	541	592
	Enclosed " ..	0	0	0	96	177

It is estimated that there are now in use in the United States about 150,000 enclosed arc lamps, of which more than half have been installed within the past two years. This record is probably unequaled in the annals of arc lamp installation the world over.

Statistics obtained from reliable authorities show that the total number of enclosed arc lamps in use in Europe (Great Britain and the Continent) is approximately 55,000, or only a little over one-third of the number credited to the United States. It should be stated in this connection, however, that the first commercial use of enclosed arcs abroad began about a year later than in this country.

Although the output of enclosed arc lamps during the past two years has been phenomenal, there are no indications of diminishing popularity. On the contrary, now that the transmission of electrical energy by alternating currents is coming more and more into favor, the field for arc lamp use will, I believe, be correspondingly enlarged. The output of enclosed alternating arcs during the coming year promises to greatly exceed that of the past, and in time to equal if not surpass that of the direct current type.

[1]Open arc series service not included.
[2]Open arcs all series.
[3]Company writes, "The enclosed arc lamp is gradually replacing the use of both the open high tension and low tension lamps on our circuits."
[4]Open arcs all direct current constant potential.
[5]Open arcs series and alternating.
[6]Open arc series municipal service not included. Company is contemplating the substitution of enclosed arcs for majority of the open arcs.
[7]Station destroyed by fire Feb. 1, 1897. After reconstruction the enclosed system was substituted for open arc series.
[8]Company writes, "During this month all of our customers that are now using the series arc are purchasing and rewiring their buildings for the enclosed arc lamp."
[9]Open arcs nearly all series.
*Approximate number.
(a) January.
(b) May.
(c) June.
(d) December.

American Electric Railway Apparatus in Hull, England.

THE City of Hull, upon the east coast of Yorkshire, is situated upon a broad estuary, opening to the North Sea. It is the most important seaport upon the northeast coast of England, having been settled over 800 years ago by colonizing bands of Norsemen. The principal trade of Hull to-day is with Scandanavia and Northern Europe. Things change slowly with such racial antecedents. In 1895, the corporation of Hull bestirred themselves, and bought up the horse tramways, the existing company having been in liquidation for some years. Electric traction has now been introduced, and the lines have been entirely relaid. The old rolling stock was also condemned. Three months ago two of the new lines, in Anlaby Road and Hessle Road, were opened for traffic. Each of these sections is about two miles in length, and other lines under construction will make the total length about 10 miles. The track is laid with 94-pound girder rails, in 60 foot lengths, with a centre groove. The gauge is standard, the rails being laid upon continuous stringers of creosoted red wood, 4 by 7 inches; the concrete foundation of the paving is carried down under these stringers, and the rails are bolted at intervals of 3 feet 6 inches to the underside of this concrete. The lines are practically level, and there are no serious curves. The overhead work of the Anlaby Road is carried on centre poles, presenting a handsome appearance, while on the Hessle Road, side poles placed inside the curb are used. The power house has been equipped with the latest economical de-

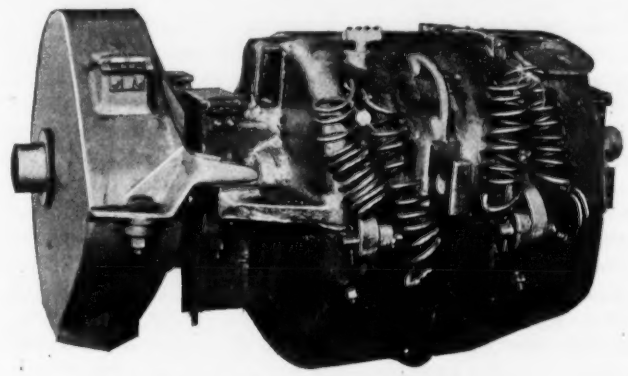

FIG. 1.—MOTOR FOR HULL CARS.

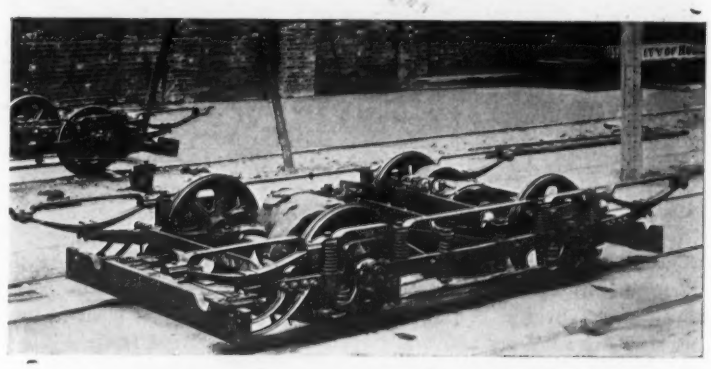

FIG. 2.—TRUCK FOR HULL TROLLEY CARS.

vices. Three dynamos driven by steam engines develop about 1200-hp.

The new cars provided for the service of the lines have been very artistically finished, being painted cherry red and cream color. They are equipped with Brill trucks, and Westinghouse street railway motors. The seating capacity is for 22 inside and 29 outside passengers. In this connection it may be well to recollect that in England it is a penal offence to carry even one passenger in excess of the number for which each car is licensed. The Westinghouse Electric & Manufacturing Company have

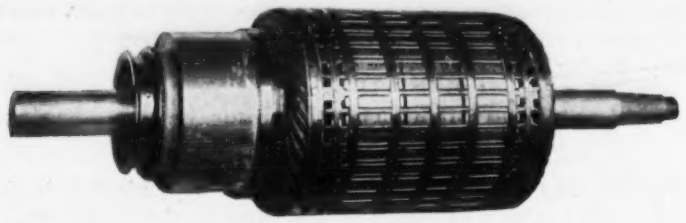

FIG. 3.—ARMATURE OF CAR MOTOR.

shipped 45 double equipments for a similar number of cars, the motors being conservatively rated at 25-hp each. The level track and absence of curves, coupled with the limitation in the number of passengers, makes these motors eminently suitable for this service. Each car is provided with 12 electric lamps, of which the two stern lamps are always cut out. They are connected five in series across the 500-volt mains. The cars have railway bearings and wheels with centre flanges to suit the grooving in the rails. Upon the opening day the new electric cars were crowded with passengers. Two views of them are shown in Figs. 4 and 5.

The Westinghouse motor is suspended on its two bearings on the car axle, and at its other end by a nose supported through springs from the bogey frame in the usual manner. The rated output of the motor is 25-hp, but at times a much greater torque can be exerted. The gear has a ratio of 4.86 to 1, and is single reduction enclosed in an oil tight case. The car wheels are 30 inches in diameter. The controllers follow the customary Westinghouse practice. The usual reversing switch is provided, and within the controller is also a commutator for cutting out one motor.

A large carshed, shown herewith, affording space for 50 cars, has been built at Liverpool Street, a turning out of the Hessle Road. This is furnished with two pits, a small one for inspec-

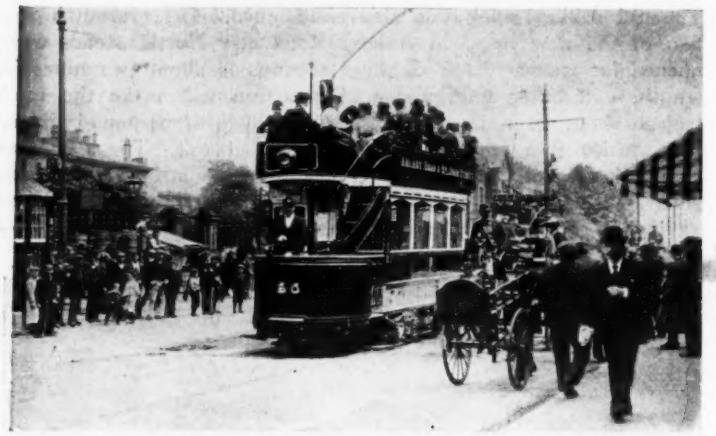

FIG. 4.—TROLLEY CAR ON STREETS OF HULL, ENGLAND.

tion purposes, and a somewhat larger one for repairing. At the terminus of the Anlaby Road line, another carshed with repair shop attached is in course of construction. The new electric lines in Hull are very popular and have developed a large traffic. Upon the opening day nearly 9000 passengers were carried by nine cars within a space of six hours.

Some improvements in design and type of street railway motors have recently been introduced by the Westinghouse Electric & Manufacturing Company, as the result of long years of experience under the crucial test of operation, and to meet the continual variable conditions of modern railway practice. Experience has taught that in this country where unfortunately there is no limitation to the load of passengers, the managers of street railroads have hitherto been too conservative in providing motors of sufficient power for the work which they are called upon to perform. Heavy expense bills for repairs have resulted. Too little attention has been given to the matter of the rise of temperature in the field, relative to that in the armature. Motors that are designed for the same maximum rise in temperature in field and armature during an hour's run at full speed under a shop test, will always have less margin in the field than in the armature when in actual service. Thus it often happens that the armature is in good condition when the field coils are roasted and ruined. The latest types of Westinghouse motors are designed so that the rise in temperature resulting from regular service will be the same in the field as in the armature, which is effected by increasing the current carrying capacity of the field winding.

The open winding of the ventilated armature has, it is said, demonstrated its superiority over that of the blanketed type, which often conceals defective workmanship. In the latest form of coils shown in the armature they are placed in the slots, allowing air spaces between them, at their ends; and the core of the armature is provided with air passages sufficient to carry off the generated

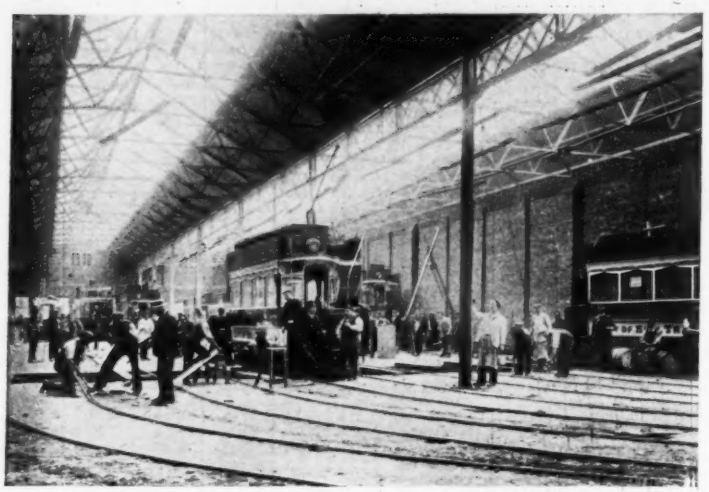

FIG. 5.—CITY OF HULL CAR BARN.

heat. Westinghouse motors following these improved designs are made in standard sizes from 20 to 150-hp, graded according to capacity. One of these motors is designed specially for narrow gauge roads where slow speed is required, but can be used on any width of track. It is identical in appearance with that shown herewith, which is the one used by the corporation of Hull tramways, and is supplied exclusively for foreign service.

Tests of the Holland Submarine Boat.

The subject of submarine boats is one of continuing importance, and the reports of tests, whether here or abroad, are received by the public with a great deal of interest. There are many reasons and facts which go to prove that the successful type of boat is that which depends upon electricity for its motive power, and for which current is furnished with the aid of storage batteries, while prime power is also available for operation on the surface, or for driving the generator. The Holland boat may be regarded as representative of the American work along these lines.

For some time past, a series of experiments have been carried on with the Holland submarine boat, by the Electric Boat Company, in the Peconic Bay, on the north coast of Long Island. So much has been said about this interesting craft that the public has become fairly familiar with such details as it is deemed fit to make known, but it may be here recalled that she is about 53 feet by 11 over all, and that fully equipped she weighs out of water about 75 tons. Of this weight, 22½ tons may be credited to the cells of the Electric Storage Battery Company, sixty-six special cells having been supplied for the work. The battery is placed in a compartment amidships, and thoroughly insulated. Over the battery stands the conning tower with steering gear and the compressed air flasks, while below it is the water tank. Astern of the battery come in order the air compressor, the gasoline engine driving the generator and the shaft thence to the screws. Immedi-

ately above is the dynamite torpedo tube. Ahead of the battery are the trimming and oil tanks in the bilge, the Whitehead torpedo in tube, the aerial gun and torpedo and the projectile magazine. These features were shown in detail in the ELECTRICAL ENGINEER of May 12, 1898. The battery will furnish 350-amp. for four hours, giving an ample speed of 8 to 10 miles. On the surface, the gasoline engine runs her at 6 knots an hour, and enough fuel is carried for a 1500-mile run. The driving mechanism is such that the generator can be driven by the engine to charge the batteries, or can

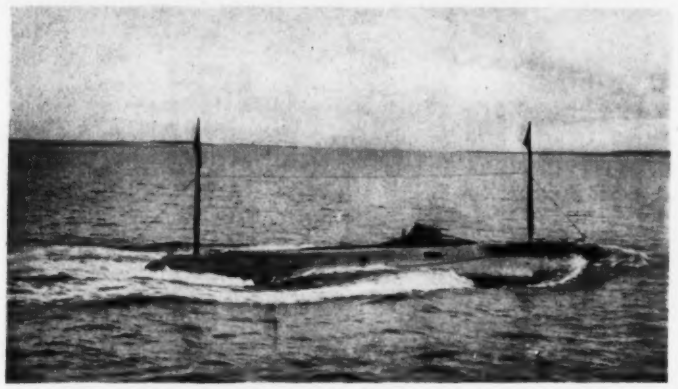

FIG. 1.—HOLLAND BOAT GOING BELOW SURFACE.

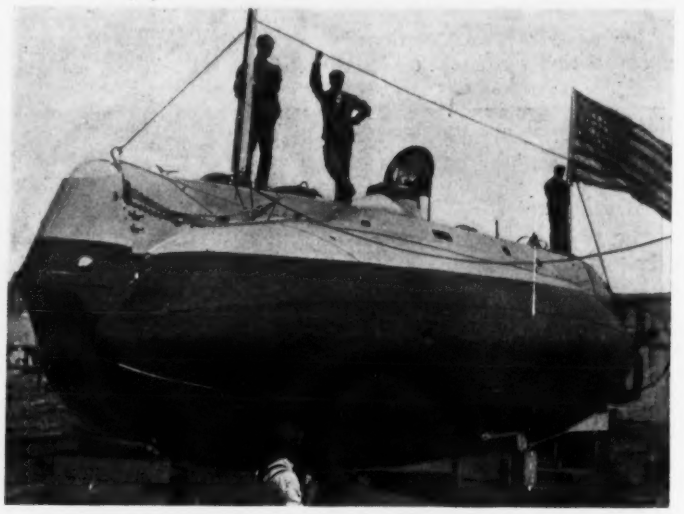

FIG. 2.—HOLLAND BOAT PREPARING FOR RUN.

be thrown off the engine and on the batteries, running then as a motor while the boat is submerged. This "motor-generator," built by the Electro-Dynamic Company, of Philadelphia, which, by the way, has just been absorbed by the Electric Boat Company, is capable of developing 50-hp at 800 revolutions, or 150-hp at 1200 revolutions. The weight is about 4000 pounds. The machine is shunt wound, and with the aid of a rheostat its voltage as a generator can be varied from 120 to 160. It has two commutators and an armature with double winding. Speed variations are obtained first by combining the two armature windings in series and including in the circuit a considerable resistance; secondly, by the windings in series, and third, by the windings in parallel. There are also a 10-hp motor for the air compressor, and other small motors for ventilating and pumping, all energized from the battery; and all the electrical apparatus for power and light is interconnected through a small and compact switchboard. While the Holland may not be very roomy, she is probably not less comfortable than the average cup defender or challenger.

The prolonged trials over the measured course at Peconic Bay and in the waters of that vicinity have, it is stated, yielded results beyond those anticipated. It has been ascertained that she can remain 24 hours submerged without danger of asphyxiating her crew of six and the torpedoman, and that her radius of action under water at 5 miles an hour is easily 6 hours. The most interesting tests have been made at depths of 20 feet, the deepest obtainable in the bay. The diagram herewith, the first that has been given out for publication, shows her run of October 11, over the two-mile course, and the scale in feet indicates also the degree of submersion at each stage of the test. The officer in the conning tower having submerged her about 10 feet and taken his bearings, carefully brought her to the course at 10.11.10. It will be seen that by the time she had reached the buoy at the end of the first mile there had been a slight deflection. This being instantly rectified by a momentary rise to the surface, she plunged under again, made an absolutely straight run for the second mile, reaching the 2-mile buoy at 10.36, when she discharged her torpedo at the circular mark ahead, made her turn and was well on the homeward run by 10:41. As the mark in actual warfare would be a huge vessel, prooably broadside on, our readers can judge for themselves the likelihood of a hit under these or analogous conditions. It would seem,

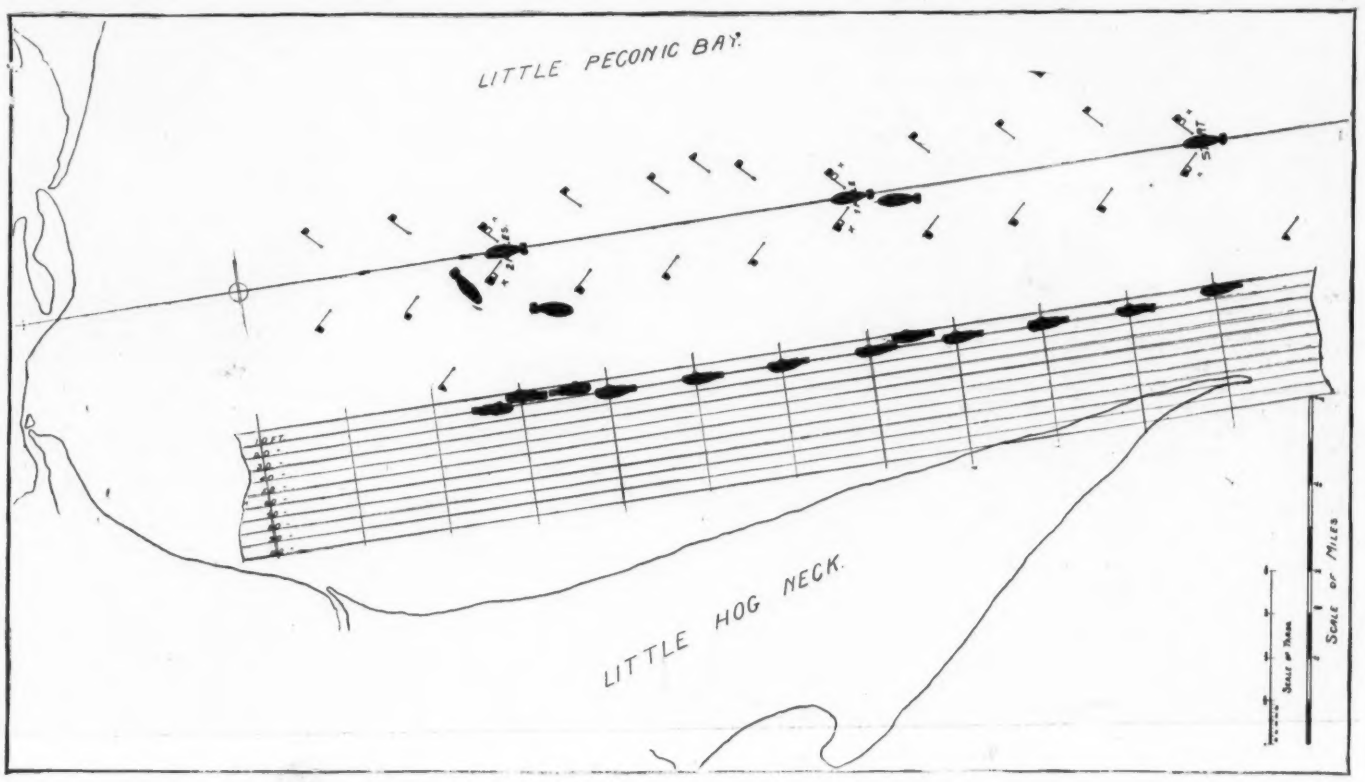

FIG. 3.—TRIAL RUN OF HOLLAND BOAT OVER TWO-MILE COURSE, PECONIC BAY.

indeed, that little remains but some actual test such as would represent the conditions of naval warfare, either with one boat of this kind in or with a mosquito fleet of them, when the expert opinions offered as to their value and availability would be adequately tested.

The National Export Exposition.

After every great international exposition the opinion is generally expressed that on account of the precedent set and the magnitude of the effort and expense involved in getting up an exposition which will attract any attention whatever, there cannot be another great exposition for several years to come. In spite of this feeling an exposition of at least general national interest and importance is held somewhere in the United States every year. The series is continued this year in the National Export Exposition which opened in Philadelphia on Sept. 14 and remains open until Nov. 30. The inspiration for this exposition was the tendency in this country toward a widespread industrial expansion, which tendency has sprung up during the last two years.

American manufacturers are now seeking for trade in territories hitherto developed only by Europeans. To provide a means of making known in such a territory the products of American industries, the Philadelphia Commercial Museum—an institution whose special purpose is the development of export trade—has fostered the National Export Exposition. The exposition is also under the auspices of the Franklin Institute, which institution has had considerable experience in the management of previous similar undertakings.

The exposition management has diligently canvassed the various countries of South and Central America as well as Australia, Asia and Europe, and obtained from importing, engineering and other houses of these countries, as well as from their commercial organizations, the promise to send delegates and representatives to the exposition. These representatives are now visiting Philadelphia for the express purpose of getting in touch with American manufacturers of reliability who make products suitable for their trade.

FIG. 1.—MAIN BUILDING FROM THE RIVER BY NIGHT.

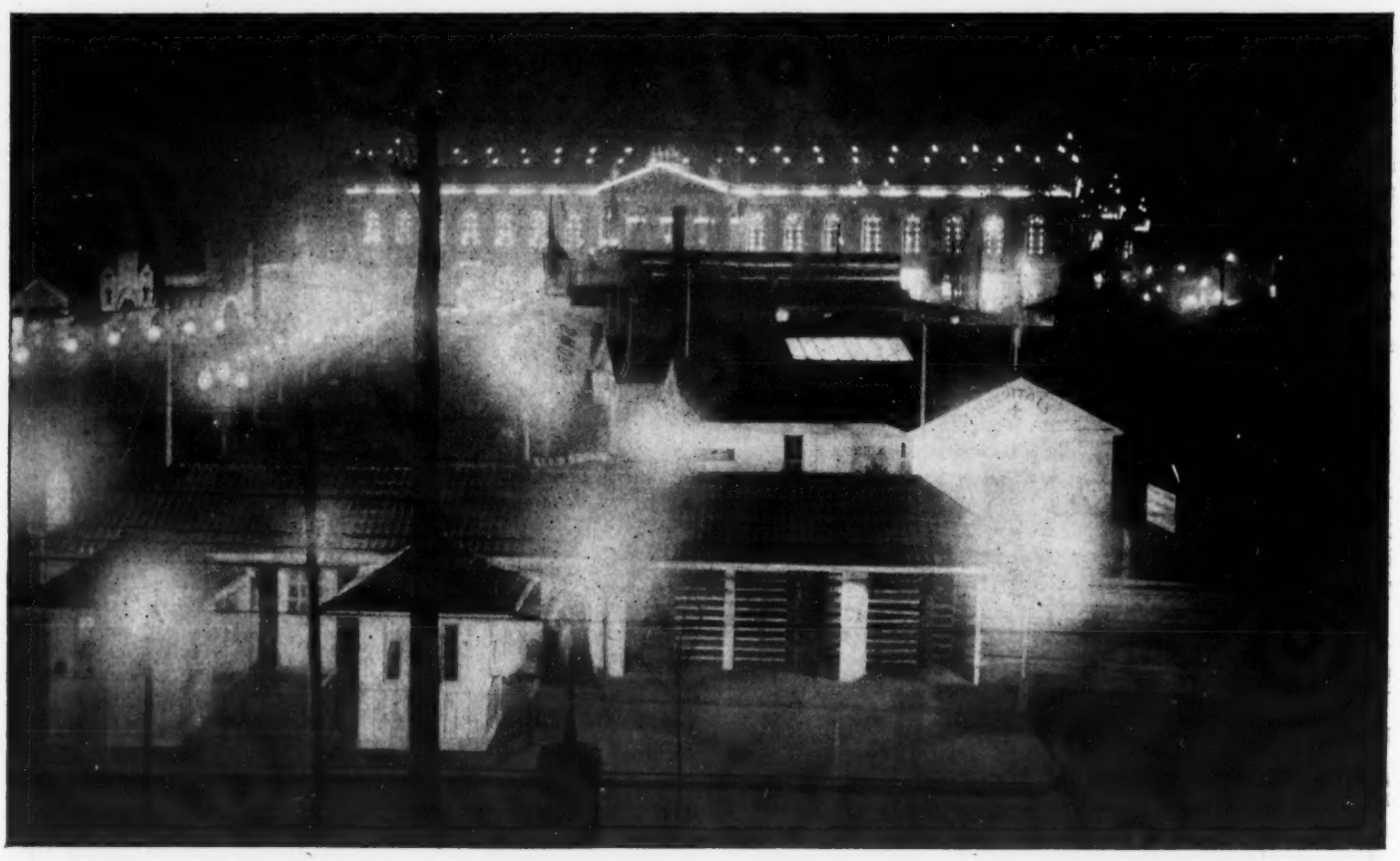

FIG. 2.—THE GROUNDS, MAIN ENTRANCE.

The magnitude of the exposition is little realized by those who who have not been directly interested in it. Between $600,000 and $700,000 have been expended for buildings and other purposes. The

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exposition is housed largely in one huge structure nearly 1000 x 400 feet in size. This building consists of three permanent pavilions of steel girder construction built under appropriations of the United States Government and intended for permanent occupation by the Philadelphia Commercial Museum. These three structures are connected with each other and made part of the one main building by temporary halls of timber construction.

As in all modern expositions, a large number of the exhibits fall under the heads of engineering, and particularly of electrical engineering. Some of these exhibits were described in these columns two weeks ago.

As in other expositions also, the illumination of the buildings and grounds by night is made a special feature. Some 3000 to 3500 incandescent lamps are used for illuminating the exterior of the main building, an idea of the effect obtained being given by the accompanying illustrations. The special feature of this illumination is the outlining of the windows, the lines of which are traced in 10-cp lamps. The cornices and roof lines of the structure are also brought out with lamps, while still other lights are grouped at the tops of the flag poles. Outside of the main building the illumination of the grounds is largely accomplished by means of gas and gasoline incandescent mantle burners of various types.

FIG. 3.—MAIN BUILDING ACROSS THE SCHUYLKILL RIVER.

The chief engineer of the exposition is Mr. John Birkinbine, president of the Franklin Institute. The electrical work was carried out under the immediate charge of Mr. C. O. C. Billberg, and for the illumination of the main building Mr. Luther Stieringer was consulted in an advisory capacity.

Prof. Rowland Before the American Physical Society.

The newly-organized American Physical Society, of which high hopes are formed by its founders as to the good effect it may have upon the advancement of physical science in this country, met in the Fayerweather Building at Columbia University, New York City, on Oct. 28, the attendance being excellent. The proceedings were opened by a most admirable and characteristic address from the president of the society, Prof. H. A. Rowland, of Johns Hopkins University, the American Mathematical Society, which was also in session, being invited to participate in that portion of the exercises. Prof. Rowland's address may be best described as an eloquent vindication of the high importance of physical studies, their nobility and their intrinsic value; and this he followed up with an inquiry into the present status of research into the composition of matter and into the tenability of the theories and hypotheses by which we now seek to explain things. Speaking of physicists, he regarded them as a small and unique body, in a country where the doctrine of the equal rights of man had been distorted to mean the equality of men in other respects. Their view of what constituted the greatest achievement in life was very different from that of people around them. In this respect, they formed an aristocracy, not of wealth or pedigree, but of intellect and ideals, holding him in highest respect who added most to the sum of human knowledge or who strove after it as the highest good. He who made two blades of grass grow where one grew before was a benefactor of mankind, but he who obscurely worked to find out the laws of such growth was the greater, the intellectual superior.

Prof. Rowland thought that in this country there was still too much concentration upon so-called practical science. The list of those gone before who had contributed to real research was meagre indeed, but it included such men as Franklin, Count Rumford, Henry and Mayer. That this had been so, was no doubt due largely to environment and lack of sympathetic fellowship, but how long the list would have been had he noted the names of those in this country who had made useful and beneficial inventions!

As to present physical problems they remained pretty much what they were hitherto: What is matter, what is gravitation, what is the ether or the radiation through it, what is electricity and magnetism, and what the interrelation of them all? Prof. Rowland then went into a searching process to show how very narrow is still the limit of actual knowledge, how scant is the proof, and how fertile is the imagination. Newton and others, for instance, had demonstrated that within planetary distances matter attracted with a force varying inversely as the square of the distance, but a proof of the law down to earthly distances remained a physical impossibility; it was all assumption. And even as to the clause, that attraction is proportional to the quantity of matter, when we could tear the sun asunder and prove that either half attracted half as much as the whole, we might have a proof worth talking about. So also in regard to the relations between gravitation and time. As to matter itself, Newton's round, hard atom has now been made infinitely elastic and endlessly subdivided, and it had had patches of electricity dabbed all over it, until at last the universe itself was simplicity in comparison. What we did know about the molecules was scant. They were not round; portions of the molecules and even the atoms could be charged electrically; some of them act like little magnets; they are elastic, and the Zeeman effect shows that the vibrating portion carries the electrified charge with it. This is a start, but does not help very far. It was certainly a wonderful feat of human reason and imagination that as much is known already.

Glancing at older hypotheses about the nature of electricity Prof. Rowland came to the ether, whose remarkable real and assumed properties he summarized with much shrewdness and force, passing in review the work and ideas of Maxwell, Hertz, Lodge, J. J. Thomson, Heaviside and others. He entered into a discussion of the effect of electrified matter in setting up ethereal disturbance, and suggested that Lodge's experiment to detect such action might have succeeded had he used an electrified revolving disc. To detect something dependent on the relative motion of the ether and matter had long been the great desire of physicists, but even the aberration of light experiment had been shown by Stokes to be susceptible of two explanations; while Foucault's results on the passage of light through moving water could no longer be interpreted as due to the partial movement of the ether with the moving water. As a matter of fact, when electrified bodies moved through space or with reference to each other, we could as yet trace their mutual actions under but very slow and very uniform velocities. All the rest was but imaginative, and while a mathematical investigation might clear up things, it was subject to "the law of the conservation of knowledge," and you never got out of it more than you put in. Hence, for example, also, such calculations as the velocity of cathodic rays from their electromagnetic action, were subject to serious reservation. The tendency of young physicists to this "extrapolation" was to be guarded against, lest the reasoning process should become at last a mere flight of the imagination.

Prof. Rowland elicited much applause by the passages in his address recommending the physicist to keep an open mind. There were no such things as absolute Truth and Error, in regard to any fact or theory. The ordinary mind had but two compartments, one for each of these, and things were generally mixed in both. The scientific mind was in infinite compartments, and every theory and observation just shifted a law or principle along, now in a compartment nearest certainty and now further away from it. Thus the fluid theory of electricity which was once in a compartment well up the scale of truth had got shifted pretty nearly down to the hole of absolute error. In other words, the scientific mind confronted nature in a state of balance, which the slightest new evidence might swing in any direction. It was above all things agnostic within its own field, and skepticism was its finest attitude.

As to the future of physical study, Prof. Rowland animadverted on its still slim equipment, so that while a hundred million dollars

were readily forthcoming for purposes of human slaughter, one per cent. of the amount was grudged for the endowment of science and of its teachers. Where, he asked, even now, could the discoverer in pure science earn more than the wages of a day laborer or a cook? Nevertheless, they must press forward with confidence, holding their heads high, with pure consciences, hopeful for the next century, and trusting that their society would do its share to unravel these great problems of the laws and constitution of the universe.

During the morning, the society adopted its constitution and by-laws. It is to have a president, vice-president, secretary and treasurer, who with eight other members will constitute the governing council. The term of office is not more than two years in succession for the president; four years without immediate re-election for council members, and one year for the other officers above named. Four regular meetings ordinarily in New York are to be held each year, and one of these, the annual, between the 26th and 31st of December inclusive. Officers are to be elected by ballot sent out in advance, but in case of failure to elect by ballot, the members at the annual meeting are to pick by ballot between any two having the highest number of votes. The election of new members is in the hands of the council. At present there is only only one class, although it is proposed to add honorary and corresponding. The annual dues are $5 per year. The society is to issue a bulletin of its proceedings in the hands of a board of three members as its editors. Mr. Ernest Merritt, of Cornell, is the present secretary.

During the day Prof. Rowland presented three or four notes detailing some interesting experiments, with negative results, as to relative motion of the matter and the ether, etc. Prof. A. S. Webster read two papers, one of them being "On the Induction of the Equations of Electromagnetic Waves." Dr. M. I. Pupin presented a paper on an "Electrolytic Rectifier of Alternating Currents."

Electric Motors On U. S. Ships.

The annual report of Rear Admiral Melville, Engineer-in-Chief of the U. S. Navy, deals at considerable length with the question of electrically-driven auxiliaries, and reviews the long discussion on this important subject. Upon the whole, he thinks the opportunities for electric power on shipboard, in spite of its many advantages, are limited by insuperable conditions. He says:

For some time past—in fact, ever since the successful use of electric motors for general power purposes on shore—the Bureau has been carefully investigating their adaptability to the driving of the numerous auxiliary engines on board ship, and, in view of the conclusion that the electric drive of the auxiliaries would not, under existing conditions, be so satisfactory and economical, on the whole, as the steam drive, believes it would be of interest to state the reasons for this conclusion.

This is the more appropriate, because in some quarters the fact that electric motors are extensively used on shore has led to the belief that they would be equally successful on board ship. The Bureau has planned to use electric motors exclusively in its new plant at the Brooklyn Navy Yard, and it will be readily appreciated, therefore, that their non-use on board ship is for very good reasons.

The advantages claimed for electric motors over small steam engines on board ship may be classed as greater ease of operation, avoidance of heat, which accompanies the use of steam pipes in living places, and much greater economy. Against these, however, are to be put the much greater weight of the necessary electric outfit, the greater delicacy of the type of electric motors ordinarily used, the lack of ready adaptability to the various conditions of service, a general denial of the claims for economy as ordinarily presented, and the increase in the amount of space required below the protective deck for the installation of the necessary dynamo rooms, this space being necessarily taken from coal bunkers.

On board ship, where excess of weight is so carefully guarded against, it would certainly be very unwise to adopt a change of motive power involving a great increase in weight, unless the advantages gained are very material. It must always be remembered that, speaking generally, on board ship the use of an electric motor involves a total weight for the motive power at least three times that of the motor itself, because there is always the generator and its driving engine, besides the motors supplied by them; or, in other words, the electric drive of an auxiliary will weigh at least three times as much as the steam drive, assuming the motor to weigh no more than the engine it displaces, although usually it does weigh more. The answer which would be made to this is, of course, very familiar to anybody who has studied the problem, viz., that the auxiliaries are not all in use at one time, and that therefore the generator capacity required is considerably less than the total motor capacity. This is another case where a statement which may be true elsewhere is not true for the circumstances on board ship. Our naval machinery has to be designed so that in time of action everything can be ready for use, and, as a matter of fact, a very little study of the question will show that it not only may but almost certainly would happen that every auxiliary on the ship, except the capstan engine and some of the boat winches, would be used simultaneously.

I wish to emphasize the point that the objection to using electric motors for driving the auxiliaries on board ship is not an objection to the use of electric motors per se, but to installing them in a location for which they are not adapted, and where their good features cannot be utilized. What has led to the wide use of electric motors on shore is not only the absence of heat, cleanliness and ease of installation and operation, but above all the simplicity of the transmission of power from a central station to a distance. Now the great majority of the auxiliaries on board ship are so near the boilers that less piping is involved in a direct steam drive than in an electric drive from dynamos necessarily at some distance from the boilers.

The ease of transmitting power to a distance over a wire, as compared with great lengths of steam piping, gives the electric drive a very attractive side, even for distances no greater than the maximum ones on board ship, so that we should naturally expect to find electrically-driven capstans and steering engines. These two auxiliaries are not under this Bureau, but are the ones requiring long and objectionable steam pipes through the living spaces. Here, however, another point has been made by some who are very anxious to use motors elsewhere, viz.: That for the service in these cases motors are not sufficiently reliable. Naturally a system involving four parts, each liable to break down, is more delicate than one involving but two of these parts. With a steam drive there are the boilers and the steam engine driving the auxiliaries. In the electric drive we have the boilers, the steam engines and also the electric generators and motors. It is merely a detail whether the steam engines operate the auxiliaries directly or whether a smaller number of them, having a greater power in each engine, operate electric dynamos. Personally I should think, however, that if motors are considered sufficiently reliable to drive feed pumps and air pumps on shipboard, for which they are not well adapted, they would be reliable for these other two cases noted, which they fit so well otherwise. The absurdity of an electric drive of auxiliary machinery on board ship situated closer to the main engines than the engines driving the dynamos becomes all the more apparent when contrasted with the steam drive for auxiliaries situated in the very extreme ends of the ship.

On the battleship Alabama the space required for electric motors, where used, is approximately the same as that required for steam engines to do the same work. The space required for the wiring, etc., is less than that necessary for steam piping, had that been used. The space required for the generating sets is 10,140 cubic feet. The capacity of these generating sets is 256-kw total. If all the auxiliary machinery on board this ship were operated by electricity, and if the space required for the electric generators were increased in the ratio of the increase of necessary capacity in the generating room, the space that would be required in the generating rooms would be 50,700 cubic feet for a capacity of 1280-kw. Consequent upon the extension of the use of electricity would be an increase in the total weight of the machinery equal to from 150 to 250 tons as a minimum. This loss in weight is as much as the gain following the use of water tube boilers. The increased space occupied by the larger generating rooms would accommodate 900 tons of coal, or 3600-hp could be added to the power of the propelling engines, giving the ship in the first instance 45 per cent. greater coal endurance or in the second instance 1.5 knots increase in speed.

The operation of electrical machinery is purely mechanical. That this may be done efficiently requires good mechanical ability at the generating engines. Electric difficulties and casualties are almost always questions of mechanical engineering. I know that it would conduce to the efficiency of the service, to the feasibility of a more extended use of electricity, and to an increase in the life of electrical apparatus if the electric generating plant were placed in charge of this Bureau. I therefore recommend that this change be authorized.

Proceedings of the International Commercial Congress at Philadelphia.

THE Commercial Congress at the Export Exposition in Philadelphia resumed its sessions last week, when a number of important and interesting topics were taken up.

Llewellyn Smith, of London, spoke on "Uniformity in Trade Statistics." He said that commercial statistics bear to national industry a relation not unlike that which bookkeeping bears to individual business. They are a test of the condition of trade at a given moment and a record of its progress over a period of time. All civilized countries publish more or less detailed figures showing their business relations with other countries. They are issued at irregular intervals. A uniform practice would be of great advantage. They should be presented by each country in such a way as to permit a ready comparison with those of other countries. But, whether uniformity of practice be practical or not, the present divergencies should be fully understood and continually kept in mind by those who handle the statistics of foreign trade.

Carroll D. Wright, United States Commissioner of Labor, followed Mr. Smith on the same subject. He said:

"Whenever the student or the writer or the legislator, and especially the latter, consults official statistical publications, he has a right to assume that what he finds there has been properly classified. When he undertakes comparisons of international trade to determine the volume of trade of one country as against that of another he will find the difficulties increase to such an extent that he cannot arrive at a clear idea of the facts. His very first difficulty will be found when he uses the statistics of exports of one country to another country in comparison with the statistics of imports of the latter from the former."

He said the two main sources of information in this country concerning the statistics of foreign trade were the reports of the customs officials published by the Bureau of Statistics and the various publications of the Treasury Department, and the reports of foreign Governments republished in a summary form by the Bureau of Foreign Commerce of the Department of State. Owing to the diverse systems of collecting the statistics, comparison of the reports was almost impossible. He gave some statistics from these reports covering the commerce between the United States and Great Britain, showing a great difference between the results obtained from the two reports, and said:

"This great difference may be accounted for in a number of ways, the most important of which is that of the difference in the methods of valuation. The attempt was made to make a comparison of particular classes of goods by quantities rather than by values, in order to eliminate this item, but here the equally great difficulty was encountered that totally different systems of classification have been adopted, with the result that it was practically impossible to make such comparison for any important single commodity or class of commodities."

The chief obstacles to be overcome were: "First, The method of classifying the various categories of exports and imports; second, the method of valuing imports and exports; third, the method of registering imports and exports according to country of origin and ultimate destination, as distinguished from the country of immediate import and export." Under the first head it is found that not only does the method of classifying the various categories of imports and exports vary greatly in different countries, but there is a great variation in classification in the same country. Under the second head the method of valuing imports and exports differs; in one country imports are valued at the port of departure and in another country at the port of arrival. In some cases they are determined from the statements of the shippers and in others by a permanent Valuation Commission, which fixes a schedule of prices. The third obstacle is through the methods of registering imports and exports according to the country of origin and ultimate destination, as distinguished from the country of immediate import and export, and under this method there is probably more deception than under the other two.

"The problem to be considered by the Congress was to consider what means can be taken to overcome the difficulties outlined." Mr. Wright suggested that the Philadelphia Commercial Museum might undertake this work. With the means at its disposal, joined to the means which might be contributed by the National Board of Trade and different boards of trade and commerce throughout the country, a bureau might be established that would act far more promptly than a government office.

Mr. Laurie, of the London Chamber of Commerce, referring to the suggestion that private individuals should undertake to assimilate statistics, said the result would be that there would be two classes of statistics, one by private enterprise and the other by the government, and they would not agree. The official statistics would be preferred. The result would be to leave the matter just where it is now. He said delegates from different countries should be asked to come together to see how the statistics could be assimilated. He had no doubt that such a convention would result in action by various governments to accomplish the desired result.

Mr. Wilfred Powell, representing Great Britain, said he considered it his duty to submit a proposal for an international Statistical Bureau to his government. Such a plan, he believed, was once devised for the collection of statistics, and was submitted to the different governments, but it met with no success. He thought a system of gathering agricultural statistics only would probably meet with more favor.

Prof. Thomas Henry Gore read the paper of Dr. F. Mendenhall on the "Universal Adoption of the Metric System." The paper was designed to show the difficulty of carrying out any system of international commercial statistics while the weights and measures of various countries were so widely different, and where these differences were marked even in the same country. He instanced as an example of this the various meanings of the word "bushel" in the United States. Mr. Gore spoke of the variations which the lapse of time may have made in these standards, and the certainty that the originals could not now be reproduced. He gave in some detail the standard measurements upon which the metric system of measurement was based, and showed the facility with which they could be reproduced in case of the destruction of the standards. The manifest advantages of the metric system were then shown, and the speaker considered it most remarkable that England, Russia and the United States alone were the only nations which had not adopted the system.

"An Isthmian Canal" was the subject discussed on Tuesday by the Congress. The papers presented all advocated the building of a ship canal to connect the Atlantic and Pacific oceans. The majority of the speakers were from the Central American countries, and advocated the completion of the Panama canal rather than a canal by any other route. The Nicaragua route was earnestly advocated by a delegate from Costa Rica. Mr. Monaghan, consul general at Chemnitz, Germany, who presided, said that the German emperor had recently said that Germany's future lies upon the water, and the vast energies of that most remarkable ruler since the days of Frederick the Great seemed to tend towards obtaining power on the water. The empire has been covered by a vast system of canals. Russia has emulated his example, and projected a vast network of canals for the development of her great empire. Mr. Monaghan regarded it as a most astonishing thing that this republic, with its business men noted for their enterprise and intelligence, did not build the Nicaragua canal fifty years ago instead of simply thinking about it now.

The Suez canal, from 1868 to 1884, had saved for the world the vast sum of three thousand millions of dollars, and a gentleman had just informed him that as soon as the Nicaragua canal is built it will save $400,000,000 annually. "Suppose," said he, "it should cost $200,000,000 instead of $100,000,000, as estimated, the cost would be a mere bagatelle compared with the saving to commerce."

The chairman, in presenting the next speaker, H. A. Gudger, United States consul at Panama, paid a high compliment to the intelligent service rendered in recent years by the American consuls in foreign ports. Mr. Gudger prefaced his address by referring to the various routes suggested and explored for a canal to connect the Atlantic and Pacific oceans. What the American people wanted to know is which route is most feasible. In the course of two years' residence at Panama he had informed himself as to certain facts. Nature pointed the way from Colon to Panama. It had been known for half a century that this is the most feasible route; yet, notwithstanding the outlay of millions of money, and the fact that shiploads of passengers and freight continue to go by way of the Panama railroad, the United States Government is looking to build a canal to divert that traffic to another route. That miles of the Panama canal had been well built no one could gainsay. It is

estimated that one-third of the entire work has been completed. The old canal company has gone into liquidation, and a new and strong company has been organized, which is composed of men of the highest probity.

At the afternoon session the chairman introduced J. J. Ulloa, Consul General of Costa Rica, who advocated the Nicaragua route, where, he said, the canal could be constructed at a cost of $135,000,000, and would run through a beautiful country of great fertility.

The achievements of American railroads and their relation to commercial, industrial, and agricultural interests were set forth in an address by George H. Daniels, general passenger agent of the New York Central and Hudson River railroad and president of the American Association of Passenger Agents. He said: "It is beyond question that American railroads to-day furnish the best service in the world, at the lowest rates of fare, at the same time paying their employees very much higher wages than are paid for similar service in any other country on the globe. In the United States the first-class passenger fares last year averaged 2.14 cents per mile, although on some large railways the average was several mills less than 2 cents per mile; in England the first-class fare is 4 cents per mile; third-class fare for vastly inferior service is 2 cents per mile, but only on certain Parliamentary trains. In Prussia the fare is 2.99 cents per mile; in Austria, 3.05 cents per mile, and in France 3.36 cents per mile.

They have now in Japan more than one hundred locomotives that were built in the United States. In Russia they have nearly 1000 American locomotives, and practically every railway in Great Britain has ordered locomotives from this country since the beginning of the war with Spain. It is not alone our locomotives that have attracted the attention of foreigners who have visited our shores; our railway equipment generally has commanded admiration and is now receiving the highest compliment, namely, imitation by many of our sister nations. The demand for American locomotives from all parts of the world is attributable, in the first place, to the superior quality of our machinery, and, in the second place, to the fact that the general passenger agents of the American railways have, through their advertising, made the marvelous results accomplished by our locomotives household words in every country on the globe.

Col. Charles Page Bryan, United States Minister to Brazil, made a brief address on "Trade Conditions in Brazil." He said it was no secret that the paramount desire of our Government is to extend our commercial relations. Whenever the subject is discussed in relation to Brazil the great disparity between our exports to and our imports from that country is mentioned. As Brazil is the traditional friend of the United States, no reason exists for delaying to improve our commercial relations. Many lines of production in the United States would find a market there under the tariff about to be put in force in Brazil. One great necessity he considered to be the establishment of American banks in that country and steamship lines running directly from the United States to South American ports.

Mr. Adams next presented Eugene Seeger, United States Consul to Brazil, who said that the great Republic of North America should have much to do with the enterprises now on foot to connect the great southern countries of South America with Brazil and its commercial ways to the trade metropolis of the world. German capital had done much there which the United States should imitate. Within the last ten years the Hamburg Line had placed thirty-one steamers in direct communication with the east coast of South America, six being put in service last year, and two more will be added this year. This country should make up for lost time and as soon as possible establish regular steamship lines and branches of American banks. No more promising field could be found for the use of banking capital. Banks there are paying dividends of 12 to 16 per cent., and could make 18 or 20 per cent. if they were not afraid of overtaxation. Loans are made at 1½ per cent. a month on the very best security.

Ex-Mayor Charles A. Schieren, of Brooklyn, addressed the delegates on the value of our export trade if continuously pushed. He said in part: "Every foreigner who visits our industries expresses surprise at our improved machinery. In almost every article manufactured in this country we excel in labor-saving appliances. Our mechanics seem to be more diligent and to produce more goods even when operating the same machinery than do foreign workmen. While wages are higher in this country, in some instances almost double what they are abroad, by quick and skilful handling of our machinery, the American workman is able to do more work, which enables the employer to compete with foreign manufacturers even at the low rate of wages abroad. In prosperous times such as at present, the average manufacturer is likely to enlarge his plant and to put in more machinery in order to supply, as he says, the growing demand. He believes these prosperous times will continue indefinitely, consequently he extends his facilities until they have reached immense proportions. But suddenly a change takes place, perhaps through a disturbance in our political atmosphere, which is liable to occur at any time, because of our peculiar system of government, when, every four years, a new administration begins. It is in such a period that our sanguine manufacturer suffers. He piles up an alarming supply of goods, with no immediate market in sight. At this stage he realizes the desirability of a foreign market, and hastens his representatives abroad to seek it. But he learns very soon that a foreign market cannot be so easily obtained, even by lower or ruinous rates. He finds the foreign buyer careful, almost suspicious, and very likely has made connections with an American manufacturer who has used foresight in establishing an export trade in prosperous times. Our goods find favor for quality and fine workmanship, but our manufacturers do not seem to have persistency and in many instances neglect foreign trade for home trade when times are prosperous. In those prosperous times preparations for an outlet for the surplus should be made, and manufacturers should not be dependent upon the brief period of a boom at home."

Mr. U. D. Eddy, the veteran export merchant of New York City, made a most interesting speech, primarily upon the South American trade, but dealing also with export trade in general. He said that when he first visited Buenos Ayres, thirty years ago, the city had, perhaps, 150,000 inhabitants, and hardly any American exports. It was a mediæval city. To-day it is modern, with a population of 800,000. Much of this transformation from the ancient to the modern has been accomplished by Americans and by the utilization of American inventions and productions. American boilers fed with American coal furnish steam to American engines; these drive American dynamos and send electrical current over American copper wires; this current is fed to American trolley cars, which run upon American rails. Americans are laying asphalt pavements there. Important commercial houses are established and devoted entirely to the extension of trade with the United States. These houses are following the customs of England and Germany in taking young men from the United States and educating them in the necessities of the trade of that region.

As to general export trade in manufactures, he said: "It will be noted by a study of the export trade of the United States that our exports and manufactures are almost exclusively of articles that can be made by machinery and in which the same article can be reproduced of the same pattern again and again. In order to produce economically and to export against the competition of other manufacturing nations of the world, it is necessary to manufacture in larger quantities in order to obtain the economies that are not obtainable except by buying raw materials, transporting them, and turning them into merchandise in very large quantities. The small savings made at these various points by the larger buyer and the larger seller are sufficient to make a profit. The evolution in the export trade of manufactured goods from the United States has and will move on the lines of the exportation of goods of large consumption which can be cheaply repeated. The United States cannot expect to excel in the supply of merchandise for the individual. That trade can be properly left to Europe; it involves smaller units of manufacture and more hand labor.

"In American electrical machinery certain types are produced; these are the results of the best experience of the most accomplished engineers. A plant is equipped with machines of the accredited type, which can be made in large numbers with the greatest economy. In England the engineer designing an electrical plant will generally insist upon modifications of more or less importance. As a result, great numbers of patterns have to be made, and many changes, which involve a much higher first cost for the manufacturer. The electrical engineer who is constantly designing machinery for the largest users is much more expert and knows better what is the best construction than can any engineer who to-day designs an electrical plant and to-morrow a plant of some other branch of manufacture."

CURRENT NEWS AND NOTES.

GLASGOW UNIVERSITY.—Lord Rosebery has been elected Rector of the University by 829 votes against 515 cast for Lord Kelvin, who stood in the Conservative interest, while his successful competitor is expected to resume soon the Liberal leadership.

WIRELESS TELEGRAPHY IN WAR.—The British military authorities hope to have the wireless telegraph in operation in South Africa within three weeks, when, it is hoped, the difficulties experienced from the cutting of wires will be obviated, as it will only be necessary to establish communication with a point at which the ordinary wires are intact.

ADJUSTABLE ALTERNATOR FIELD.—A patent was issued Oct. 24 to Nicolas J. Laschet, of Darmstadt, Germany, on a means for adjusting the air gap between the armature and fields of alternating current machines, and particularly applicable to the stators of alternating current motors of the single-phase and polyphase type. The stator portion of the machine consists of an annular casing which supports within it the field proper or non-rotatable member, by means of threaded rods between the casing and the said member.

WATER POWER DEVELOPMENT IN NEW HAMPSHIRE.—It is stated that plans are being completed by business men and capitalists of Manchester, N. H., for the establishment of a large electric light and railway plant at Garvin's Falls. At this point the Merrimac River has a fall of 30 feet, constituting the second largest water power in the state. The project has been discussed for several years. It is proposed to transmit electric power from Garvin's Falls to Manchester, to supplement the power of the Amoskeag. It is stated that $100,000 will be expended in the improvements.

WIRELESS TELEGRAPHY IN THE ARMY.—It is reported from Washington that the proposed experiments in the army with the Marconi system of wireless telegraphy have been abandoned for the present. It was proposed to have a series of tests at Fort Myer and at Sandy Hook, and the arrangements had almost been completed, when Mr. Marconi demanded what the Department considered exorbitant concessions from the government for the use of his system. Capt. Squiers, of the Army Signal Corps, has not given up the matter entirely, however, and will have another conference with Marconi with the view of effecting some arrangement.

ELECTRICITY AND FOLIAGE.—An extraordinary phenomenon is said to have been noticed with regard to the chestnut trees in the Avenue Louise, Brussels, since the installation of the electrical trams. Their foliage begins to turn brown and drop early in August, to bud, and even to blossom, again in October. The trees on the opposite side to the tramway behave like ordinary trees, for they lose their foliage in the late autumn and do not put forth fresh blossoms until the spring. Botanists are inclined to believe that the cause of this singular state of things is due to the leakage of the electrical current which passes underground acting upon the roots of the trees which are otherwise quite healthy.

PARIS EXPOSITION'S AUTOMOBILE CONTEST.—Exhibitions of automobilism are to be held at Vincennes next year in connection with the exposition. They promise to be a most attractive feature. One hundred thousand francs has been voted for the construction of a track and grand stands. Special prizes will be given in addition to the medals and diplomas that will be awarded by the government, or, rather, by its representatives. The exposition administration has decided that the competing machines be divided into four categories, namely, heavy trucks, cabs, victorias and voiturettes. The last class will include tricycles and motocycles. An electric charging station will be established near the race course at Vincennes, so that the electric machines may be in no difficulty about the supply of motive power when they need it.

ELECTRICAL STANDARDIZATION.—The American Institute of Electrical Engineers has reprinted the report of its committee on "The Standardization of Electrical Generators, Motors and Transformers," copies of which may be obtained for ten cents, by addressing the Secretary of the Institute, Havemeyer Building, New York. This report embodies the most important work the Institute has yet undertaken, and the adoption of its recommendations will be of much benefit to the industry, by eliminating sources of misunderstanding and promoting simplification from a manufacturing standpoint. Several of the leading electrical manufacturing companies have already signified their approval of this report and their intention of adopting it officially in their practice.

GERMAN EXHIBITS AT PARIS.—The German entries for the Paris Exposition are practically ended. From the valuations for fire insurances it appears that Germany will send exhibits worth from fifteen to eighteen million marks. Dynamos and tool machines worth from two and a half to three million marks will be shown in Groups IV. and V. In the iron machinery hall about 700,000 marks' worth of machinery will be displayed and equal amounts in the engineering and transportation and textile machines and products sections. Electrical machines and apparatus, agricultural machinery and products, foodstuffs, chemicals, paper-making machines and papers, mining machinery, bronzes, amber, army and navy uniforms, gun-making machinery, explosives, optical and fine mechanical instruments, railway rolling stock and automobiles will be shown.

THE PACIFIC CABLE PROJECT.—Capt. G. O. Squier, of the U. S. Signal Service, is compiling extensive data showing the cost of the telegraphic service between this country and various parts of the Eastern Hemisphere. It is intended for use in urging the necessity for a Pacific cable, the laying of which the President will probably recommend again in his message to Congress next December. The continued military operations in the Philippines have caused the bills for cable tolls to become enormous. Not only the War Department, but the State and Navy Departments have had to use the cables extensively, and the President has sent and received many private messages. The comparative cost of various lines will be set forth, and the Department has even gone into the matter of the Cape-to-Cairo telegraph through the continent of Africa, which is expected to be completed in 1900, and the telegraph which will accompany the Trans-Siberian Railway.

GERMANY'S NEED OF A CABLE.—The first German cable laying steamer is about ready to be launched at Glasgow. She will proceed to lay the cable between Emden, Vigo, the Azores and New York. Great importance is attached in German governmental and commercial circles to the laying of a German cable between this country and America. It is felt that if Germany's aspiration to equal England as a sea power is to be realized it is of primordial importance that German statesmen and German merchants shall be freed from their dependency on foreign cables, especially those of the English companies. During the "late unpleasantness" with Spain, as well as during the Samoan troubles, German interests were damaged by the fact that the transmission of news to and from Germany was almost entirely in the hands of foreigners. Not unnaturally the German point of view was not adequately and fairly represented under these circumstances. Now that Germany has awakened to the importance of controlling cables she will endeavor to break in with a system of her own.

AN ALL-AMERICAN PACIFIC CABLE.—In official and diplomatic quarters at Washington attention is being directed to the question of a Pacific cable linking this country with the Philippines and points beyond, and it is understood that this government and those foreign governments which would be affected by the cable are now actively considering the subject. The officials at Washington are assembling data and preparing cable maps with the expectation that the matter will be brought to the early attention of Congress. In a general way, the project is for a cable of four links, viz.: From San Francisco to Hawaii, 2120 miles; from Hawaii to Wake Island, 2044 miles; from Wake Island to Guam, 1293 miles; from Guam to Manila, 1350 miles. These landing points are all within the control of the United States, the American flag having been raised on Wake Island not long ago. This would connect all the American possessions in the Pacific by a line crossing no foreign territory. Besides this the plan permits of an expansion so as to secure two outlets to Asia and the Far East. The first of these would be from Manila to the Japanese island of Formosa, from which island Japan has built a line to the Japanese coast and the main land of Asia. The second outlet would be from Hawaii south to Fannings Island, at which point the newly projected British cable from Vancouver to New Zealand crosses. The foregoing projects would not be private enterprises, but a government undertaking.

TROLLEY WIRE GUARD.—A patent was issued Oct. 24 to E. Frischmuth, of Berlin, Germany, for a trolley wire guard. Spacing porcelain insulators disposed at suitable distances connect the trolley wire with the guard wire, and at intervals the latter is electrically connected with the railway return circuit.

THE THREE-WIRE SYSTEM.—Prof. Silvanus P. Thompson, after a recent visit to Switzerland, is reported to have come to the conclusion that the three-wire system with direct currents is played out, and that transforming-up has gone out of fashion. Another remark attributed to him is that the space behind a switchboard ought to be much larger than that in front of it.

A DANGER SIGN.—The skull and crossbones have become a familiar sign on apothecaries' labels for packages containing poison. The sign for an analogous purpose which seems to be coming into use quite extensively in Germany, consists of a conventional representation of a zig-zag bolt of lightning, which is painted on transformer chambers, poles and other places where there is danger from a high voltage electric current.

EARLY UNDERGROUND CONDUCTORS.—In a paper read before the October meeting of the Chicago Electrical Association on "Underground Electrical Conductors," Mr. H. Sewall gave references to the early work in this branch. As early as 1841 Wright and Bain put wires in a trench between layers of asphalt pitch and other cement. In 1845 Young and McNair plaited wires covered with cotton threads and introduced them into lead pipes filled with pitch, the lead sheath acting as return conductor. Reid in 1847 enclosed each cotton-covered wire in a lead tube. Whishaw in 1848 made multiple underground conduits of earthenware or pottery. Werner Siemens in 1850 placed lead conductors underground by using a plow to make a trench and trailing after it an insulated wire, which was then covered with earth. Reid and Bett in 1852 introduced joint boxes and testing boxes in underground circuits. Werner Siemens in 1851 imbedded two sets of insulated wires in a mass of gutta percha, the cable thus formed being used for submarine and subterranean telegraphy. Badouin about 1857 used large manholes with sectional conduits between them. Blocks of bituminous matter were placed around hot iron rods, and the latter then withdrawn, leaving holes through which wires could be drawn.

LETTERS TO THE EDITORS.

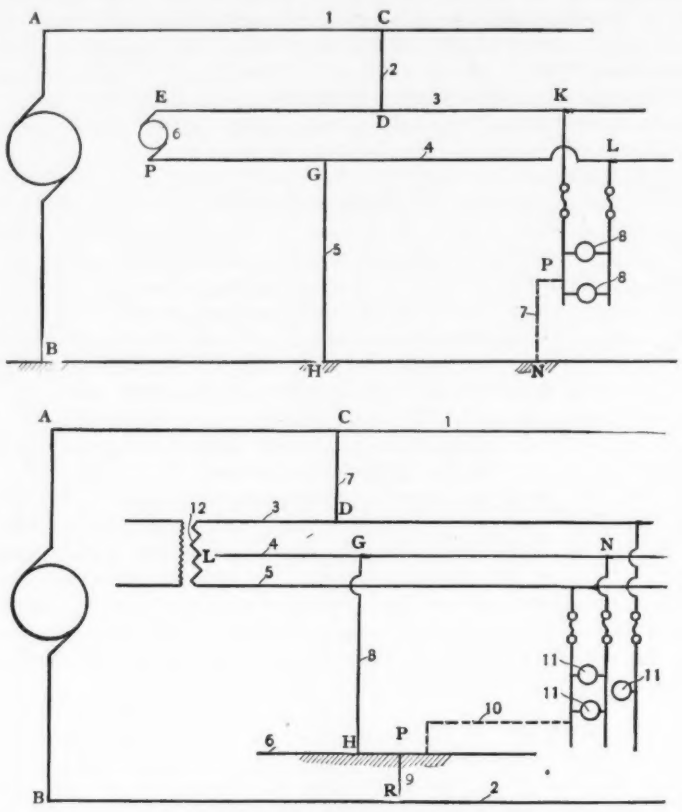
Protection of Interior Wiring from High Potential Currents.

To the Editors of Electrical World and Engineer:

Sirs:—Permit me to call attention to a number of errors in an article in your issue of Oct. 28, by Messrs. Reed, entitled "Protection of Interior Wiring from High Potential Currents."

In the article, an attempt is made to show that under practical conditions the potential of the grounded side of a low potential circuit may become greater than the potential of ground, and that the potential of the ungrounded side of the same circuit may equal approximately the potential of the high potential circuit with which it may accidentally come in contact. Figs. 1 and 2 show the arrangement of the circuits in the article referred to; the authors attempt to prove their thesis by assuming certain numerical values for the resistances of the different parts of the circuits, and thence deduce the consequence that the potential of the circuit to be protected may rise to a dangerous value. Referring first to Fig. 1, which shows a grounded 500-volt trolley circuit crossing, by means of the wire *C-D*, a low potential consumption circuit, which it itself grounded through the wire *G-H*, the authors assume the following resistances, as representing practical conditions: *C-D* .25 ohms, *D-G* .25 ohms, *G-H* .5 ohms, and say that if the difference of potential between *C* and *H* is 500 volts, then *G* will have a potential of 250 volts above *H*. This is obviously true, but represents nothing practical; the assumptions are misleading in (1) giving an appreciable value to the resistance *G-H*, (2) in ignoring the resistance of the circuit *C-A-B-H*, or what is the same, (3) assuming constant potential between *C* and *H*.

The authors fail to understand the meaning of a *permanent* ground. The proposal to protect low pressure consumption circuits by means of permanent grounds has for its basis the establishment of a series of grounds that shall be permanent and shall be of inappreciable resistance compared with the resistance of the consumption circuit. There should be more than one ground wire, and these grounds must of necessity be so made that they are permanent, that their resistance is low—and they must be tested to establish this fact—as any other safeguard must be, to insure satisfactory operation. Under these circumstances, the potential of the wire *F-G-L* is in all cases the potential of ground, i. e., zero. The potential at the point *D* can then under no circumstances rise above the voltage of the circuit plus the drop in the conductors *D-E-F-G*. Under *practical* conditions this fall of potential is of necessity small; for instance, in the alternating current circuits shown in Fig. 2, the resistances of the secondary network, for the same percentage losses, and with a ten to 1 transformation ratio would be of the order of 1 per cent. of the primary network. The same general facts would hold in all cases—



FIGS. 1 AND 2.—DIAGRAMS OF CIRCUITS.

the low pressure circuits, the ones to be protected, have low resistances. Hence regardless of the resistance of the cross *C-D*, the chief fall in potential occurs in the circuit *C-A-B-H*, unless of course *C-D* is very high, in which case the fall is in *C-D*.

The authors fail entirely to notice this point, assuming a constant potential between the points *C* and *H*. The faults of their demonstration as applied to Fig. 1 are then—first, the assumption of a high resistance for the connecting wire *G-H*; second, the assumption of resistances for the circuits *D-E-F-G* high as compared with the resistance of the circuits *C-A-B-H;* third, the maintenance of constant potential between *C* and *H* under all circumstances. It is obvious that conclusions drawn from such false premises must be equally false.

In a word, the potential at the point *D*, in practice, can never rise much above the voltage of the circuit, when permanent grounds are made at the point *G*, regardless of the resistance of the connection between high and low-tension circuits.

Without going into much detail, the same line of argument applies to Fig. 2, in which a high-pressure 2000-volt circuit is shown crossed with a low-pressure consumption circuit, of which the neutral wire is grounded at *G*. In this, as in the first case, the wire *L-G-N* is of necessity at zero potential. The potential at point *D* is then equal to the voltage of the circuit plus the drop in the wire *D-L-G*, this drop in all practical cases being small. The difference of potential between the points *C* and *R* is only constant in case the total resistance between *C* and *R* by way of the ground is high, and the current flow small. In case this resistance is low, due to very low

resistance of the wires *C-D* and *R-P*, the potential is no longer constant, but is diminished by the drop in the circuit *C-A-B-R*.

Since the potential at the point *D* cannot rise appreciably above the voltage of the circuit, it is clear that no dangerous potential can be brought to bear on the transforming devices. The Messrs. Reed have, therefore, not "demonstrated above that if a ground of small or no resistance is placed on one leg of a system, its opposite underground leg may attain a voltage destructive to the transforming devices in circuit. Therefore, such a ground becomes a menace, and the ungrounded legs of the system become crossed;" the very contrary is true, and a permanent ground will always protect a circuit. The case when the ground connection has an appreciable resistance is of no interest.

I fully agree with the writers that in view of the recent action of the American Institute of Electrical Engineers this matter should be given the most *careful* consideration, and it is for this reason that I ask you to publish this contradiction of the statements contained in the article. It seems to me that such an argument, uncontradicted, may handicap the efforts of the Institute to secure this most necessary provision.

CARY T. HUTCHINSON.

NEW YORK, N. Y.

Railway Motor Rating.

To the Editors of Electrical World and Engineer:

Sirs:—I have read with interest in your issue of October 21, Mr. Lundie's suggestion for the rating of intermittent service motors and your editorial upon it.

Some system of rating more descriptive than our present one is much needed, and I should like to see encouraged the development of a method along the lines of Mr. Lundie's note; but I cannot consider that his suggestion is applicable broadly. It seems to me limited to the class of recently designed series wound street car motors. While his title is "Railway Motor Rating," the theory laid down at the opening of his article shows that he intends to cover motors generally.

Without for the present discussing railway motors, let us see how Mr. Lundie's rating would apply to other classes of intermittent service machines. It is true these classes are not as important as railway motors, but a rule to be general should include them.

Take elevator motors. That these may act as generators in regulating the descent of their load, and for other reasons affecting their control, they are usually compound wound, with shunt predominating, or wholly shunt wound. This prevents any direct relation between field strength and amperes flowing in the armature, and for purposes of discussion field strength may therefore be considered constant. Motors like these could not be described by the average input rating; for the core losses would be approximately constant for all loads, while the resistance losses would vary as the square of the load, making a total of the combined losses to which the temperature is proportional that would vary more rapidly than directly with the load. This destroys the relation upon which the proposed rating depends, namely, that the losses and consequently the temperature vary directly with the load or input.

The considerations hold true for shunt motors in general.

It is assumed by Mr. Lundie and by you in your editorial that the limit of load by commutation waits upon that by temperature. This is not true in shunt motors, used for intermittent service over the same range as series motors. With the draft of heavy currents the shunt motor does not strengthen its field nor greatly reduce its speed, while the series motor increases its field excitation preventing excessive distortion and at the same time slows down, reducing the armature reactance.

From the absence of both of these actions the commutation limit of a shunt motor is much less remote than that of a series motor and the range over which temperature alone is the criterion, very much shorter; enough so to impair the usefulness of a purely temperature basis of rating.

Passing to motors of the ordinary belt or direct connected type equipped with series winding, the expedient usually employed for intermittent service or "lumpy load," it has not been my experience that the efficiency curves of these machines are even approximately flat for a considerable portion of their capacity, and while I have not had an opportunity at this writing to plot curves which leave out the frictional losses and which are in terms of input instead of output, I do not believe they will be sufficiently different to warrant the assumption that losses are a fixed percentage of input over enough range to form the basis of a rating.

The same is true of the large class of special intermittent service motors designed for cranes and general mill work in which liberties are taken with the design to accomplish certain particular objects, and the relative proportions of the losses are consequently such as to yield efficiency curves of very peculiar shape.

For railway motors in particular, I consider a system of average rating decidedly advantageous, and think the assumptions necessary in using it may come sufficiently close to the truth for practical purposes in the case of the modern types of street car motors.

If Mr. Lundie's rating were adopted, it might have an important effect upon designs, the departure of the assumptions from the truth being sufficient to put a premium upon motors with certain shapes of efficiency curves; these shapes not indicating special merit in the machines, but enabling them to make a better showing under a test of which the standard was to some extent artificial or arbitrary: much as vessels alter their natural lines to save tonnage tax, and yet preserve their carrying capacity.

I see no harm in adopting a system of this kind even if it is not strictly accurate and is limited to railway work. The convenience it would afford would undoubtedly be great.

AMPERE, N. J. GANO S. DUNN.

To the Editors of Electrical World and Engineer:

Sirs:—Your editorial in the current number on the subject of railway motor rating, states more clearly than in the previous number your position in criticizing the method of rating proposed by the writer.

Dr. Hutchinson's letter, contained in the same issue, which forms the subject matter for the editorial, has expanded and placed the matter in better form for discussion than was offered by the bare statements made in the brief article by the writer, contained in your issue of October 21.

Your editorially expressed objections to the proposed method of motor rating are essentially that the following two assumptions cannot be true: First, that the electrical efficiency of the motor should be constant at all loads within the commutation limit; second, that the temperature should be the same whether an excessive load were applied at the beginning or at the end of a cycle of test. You sum up by stating that while the advantages of the proposal are not to be gainsaid, yet the uncertainty of the fundamental assumption is too great to warrant its adoption.

No precise criticism can be made of your objections, as they are based on your statement (which is correct) that the assumption is not *strictly* true. As, however, the proposition is to secure a method of rating which within service limits will represent the capacity of the motor, your objections may be met as follows:

As to your first objection, you support it by stating that the combined copper and iron losses cannot be constant because the copper losses are approximately proportional to the square of the input, while the iron losses, although very complex, are roughly constant, and the sum of a constant and a square function cannot be a first-power function.

Replying to this objection, the percentage copper losses are proportional to the square of the input divided by the input, or are directly proportional to the input—a first power function. If the iron losses were considered constant, the percentage losses would be inversely proportional to the input—a hyperbolic function, but approximating a first power function on the branch of the hyperbola. The iron losses, however, are not constant in a series motor, and are such as to make the approximation of the percentage losses still closer to a straight-line function than if they were constant. In the characteristics of a motor before the writer, the iron losses are approximately proportional to the square root of the input, and the percentage losses, consequently, inversely proportional to the square root of the input. The sum of the percentage copper and iron losses in this motor throughout a range of from 40 to 200 amperes, does not vary 2 per cent. Surely this is close enough to a first power function to satisfy almost the laboratory, not to mention the demands of railway service.

The ideal to be worked towards in motors intended for intermittent, fluctuating work should be that of practically constant electrical efficiency throughout the whole range of service operation.

Your second objection as to the final temperature depending on whether overload were impressed in the beginning or end of a test

cycle, will not hold in frequent intermittent service, as we are not dealing with one cycle, but with a continued repetition of cycles in rapid succession, and the maintaining of a given maximum temperature is simply a question of the rate of radiation of heat. With a given average rate of generation of heat, and the same rate of radiation, the temperature remains a constant. The short time between applications of load in railway work does not permit of an appreciable drop in temperature, and the rate of radiation is a function of this temperature.

As to your suggestion that the testing of a motor would be a lengthy and elaborate process, this again is a result of your considering only a single cycle of test. As a matter of fact, the motor in service is under continuous test, the average rate of input as the load fluctuates anywhere within the range of operation, being a measure of the capacity under which it is being operated. This fact is one of the strongest arguments in favor of the proposed method of rating.

The writer is well aware that there are many points which will have an important bearing on the method of rating proposed, such as restrictions to free radiation, unequal heating of field and armature, etc., but believes that they may all properly be made subservient to the general proposition. JOHN LUNDIE.

NEW YORK, N. Y.

A Multiple Lightning Flash.

To the Editors of Electrical World and Engineer:

Sirs:—I have read with great interest Dr. Kennelly's article in your issue of Oct. 28 on the multiple lightning flash photographed by Mr. Justice.

For a long time these multiple flashes were attributed to wabbling of the camera or to reflection from the back surface of the plate or of the lenses. The theory which now appears to be the correct one was first given by me in the ELECTRICAL WORLD, April 20, 1899, page 552, as follows:

"Assume the flash to take place through air* moving at the rate of 30 miles per hour. Then, since the flash follows the hot air it is easily calculated that if the camera be of one foot focal length and the flash be half a mile away, then the flash will appear as a bright streak of ¼-inch width on the plate, owing to the fact that, as in the arc, the position of the discharge has moved. If the discharge be oscillatory, as it sometimes is, we will get on the plate a ribbon of greater or less intensity with parallel bright longitudinal ribbing, one rib for each discharge. I have obtained such photographs, and enclose one with three discharges."

If the half-tone of the photograph mentioned as having been enclosed be examined (it is on page 551), it will be seen that it differs in no way from that of Mr. Justice's except in the number of ribs. We have thus two recorded cases of this ribbed flash, and whilst, on account of the fact that it is necessary to have two cameras at some distance apart and an accurate knowledge of the duration of the flash before we can accurately tell the strength of wind, it may be some time before we are able to do this in any particular case, yet it is highly satisfactory to have this corroboration of the original theory, and to have such a beautiful photograph for reference.

What we want now is spectroscopic photographs of flashes. By placing a small objective prism before the camera lens, as is done in photographing the corona, in total eclipses, we will get a separate image of the multiple flash for each line in the spectrum of the flash. If the flash be oscillatory, then the bottom of each alternate rib of the mutiple flash will be missing on some of these images, and the top of each alternate flash will be missing on the others. I think I have observed a wavering of color in some multiple flashes, but only the spectroscope can make this sure.†

Dark flashes do not seem to be due to reversal as we usually understand the term, for we can have them with dark backgrounds, and when the bright flash crosses a mass of bright ones it does not show black, whereas if it were a reversal it should persist as black for a little distance, till rereversed. More work should be done on this subject. I have seen some beautiful examples taken by the Westinghouse Company, and I understand it is their intention to publish them in the near future. It is to be hoped that they may be able to arrive at the true reason.

Globular lightning I have long thought might be explained as follows: The idea was suggested to me by noticing, as has often no doubt been done by others, that on waving a highly charged knob connected to a Holtz machine about in air, small luminous balls are sometimes given off. Suppose we have a fine point, charged. The voltivity next the point is very high and the air breaks down. The broken down air is a conductor, the disassociated atoms being electrolytic conductors, as has been so beautifully shown by Prof. J. J. Thomson. A small globe is thus formed of conducting air. It grows in size till the voltivity at its surface becomes so small that the adjacent air no longer breaks down. Suppose this globe is violently detached from the point, the point being of very high resistance, so that the globe cannot discharge itself before it is shaken off. Then the globe will wander away, a luminous sphere, carried by every current of air, till the disassociated atoms gradually unite and all the energy is shed off except what remains in the form of air so slightly heated that it no longer conducts.

Imagine this taking place with very high potentials. The globe would be large, but would behave in the main as above. Should it strike a conducting substance, it would be immediately discharged with a report. I have not the least doubt but that Prof. Elihu Thomson or Prof. Trowbridge would be able to make quite respectable samples of ball lightning with the high potential apparatus at their disposal. REGINALD A. FESSENDEN.

ALLEGHENY, PA.

*An account of the effect of a high wind on widening the photograph of a continuous flash is given by Prof. Elihu Thomson in ELECTRICAL WORLD, April 22, 1899.

†With a grating the actual movement of the atoms in the flash could be measured.

Professional Degrees.

To the Editors of Electrical World and Engineer:

Sirs:—In reply to the request by Mr. Rimanoczy for opinions concerning professional degrees, I beg to say that I have always been of the opinion that: First, the degrees of M. E., C. E. and E. E. should not be conferred on four years of undergraduate work; but that, second, a man should be required to show at least three years of practical, *responsible* work in a commercial engineering position, after his regular graduation, before he should be eligible for the above degrees; and, that, third, there should be required for these degrees a satisfactory evidence of *original* work in his profession which might or might not be embodied in a thesis.

It has been my experience that the engineering profession cares more for the individual recommendation of well known instructors than for any degree given immediately on graduation.

LUCIEN I. BLAKE.

UNIVERSITY OF KANSAS, LAWRENCE, KAN.

To the Editors of Electrical World and Engineer:

Sirs:—I give below answers to the questions in the letter of Mr. B. Rimanoczy, appearing in your issue of October 21, excepting question 4.

1. No, if the question means at the end of four years.
2. After three years of successful engineering work.
3. Yes.
5. Lastly; this does not seem to be a question of legitimacy. M. D.'s hold legitimate degrees, but I don't think they count for as much, so far as concerns guarantee of quality of professional work, as do engineering degrees given at the end of an engineering course. If a bridge falls down when it should stand, the error is rather widely known. If a patient dies when he should have been carried through to recovery, a physician's certificate covers all. That seems to me to account for the success of the medical profession with the scanty preparation which has been formerly more common than now. F. E. NIPHER.

WASHINGTON UNIVERSITY, ST. LOUIS, MO.

To the Editors of Electrical World and Engineer:

Sirs:—Below I give categorical replies to the questions of Mr. Rimanoczy:

1. The degrees of M. E., E. E., etc., should not be given for four years undergraduate work.
2. Should demand one full year of past graduate study in college, or three years' practice of the profession. In either case also a thesis.
3. A thesis should be required.

4. A good basis from which to acquire practical knowledge of details.

5. Personally, I believe the engineering degrees require much more thorough preparation than that covered by the usual M. D. degree. The latter is really an undergraduate, or bachelor's degree.

JOHN W. LANGLEY.

CASE SCHOOL OF APPLIED SCIENCES, CLEVELAND, O.

To the Editors of Electrical World and Engineer:

Sirs:—Referring to the letter of Mr. B. Rimanoczy, contained in your issue of October 21, 1899, I offer the following replies to the queries therein contained:

1. "Should the M. E., C. E. or E. E. degree be conferred after four years of undergraduate work?" No.

2. "If not, what time after graduation should a man be required to spend in engineering work before he is eligible for a degree?" At least three years, which should include one year of resident graduate study.

3. "Should a thesis be required for these degrees?" Yes.

4. "What does the engineering profession think of the above degrees, as held by men just out of college?" Not prepared to say.

5. "Is the M. E., E. E. and C. E. as legitimate to its holder as M. D. is to a graduate of a medical college? In other words, is a young doctor more proficient than a young engineer?" Yes, other things being equal, a man with a properly earned M. E., E. E. or C. E. is as well qualified for his work as one holding the degree of M. D.

JAMES S. STEVENS.

UNIVERSITY OF MAINE, ORONO, ME.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Sparkless Commutation.—ISLER.—The first half of a summary of the more recent development and results of the theory of Fischer-Hinnen, who toward the end of last year published a long paper on the theoretical conditions involved in the commutation in direct current machines. The present paper is largely analytical in character, and the equations are not such as can be given here. Among other things he states that sparking is due to the fact that the current density becomes too great in the brushes, and that this condition is most frequent in the last moments of commutation, that is, at the toe of the brush; in all cases it is claimed to be certain that there will be no sparks if the current density under the brushes during the whole of the commutation remains approximately the same. Sparkless commutation can be expected only when the voltages at the beginning and end of the commutation have certain values given by his equations. A number of results of experiments by others are compared, among which are those by Cox and Boch, published in this country in 1896.—*Elek. Zeit.*, Oct. 12.

The Short Circuit Curve of Alternators.—ZIEHL.—In a long communication he makes some remarks concerning the theory of Rothert (Digest, Sept. 30, Oct. 7), and gives the results of tests made by him on several machines. He agrees that Rothert's diagram has proved to be of practical value, but points out that Arnold and Fischer-Hinnen have also advanced theories which give good practical results; the accurate solution of this problem has not yet been found. He remarks that in Rother's article a theoretical predetermination of the drop of voltage is not considered, and he criticizes at some length a certain point in Rothert's comparison of three-phase and single-phase generators. He gives a formula for the predetermination of the armature ampere windings for single-phase alternators, which he found satisfactory in practice. In regard to the use of the ampere winding diagrams for calculating the drop of voltage, he says that he found the values of the primary ampere windings calculated in this way throughout too small, which he thinks is a result of the increase of primary straying. He modifies the diagram slightly to include this.—*Elek. Zeit.*, Oct. 12.

Non-Synchronous Motors and the Theory of Magnetic Mirrors.—S. P. THOMPSON.—An abstract of his Como Congress paper, in which he applies the theory of magnetic mirrors to non-synchronous motors, explaining the action of the latter by means of it. The armature winding represents the mirror or screen and the real pole is generated by the field currents and has the form of a plane. By using the Heyland diagram and the Fresnel method of replacing an oscillating vector by two rotating vectors, he develops the diagram of a single-phase motor and shows that the armature current is not represented by a straight line, but by an ellipse, whose width diminishes with the armature resistances. Also that the loss by current heat in the armature is double that of a three-phase motor of the same size and output.—*Elek. Zeit.*, Oct. 12.

Three-Phase-Single-Phase Transformers.—GRASSI.—A brief abstract of his Como Congress paper. The object is to obtain single-phase currents from three-phase current mains. The primary coils of three transformers or of one triple transformer are star connected, while the three secondary coils are connected in series. If 1, 2 and 3 represent the three primary coils and *a*, *b*, *c* the corresponding secondaries, then the desired results will be obtained if the number of windings of 2 and *b* are about twice as great as that in each of the other branches. The three primary circuits will be unsymmetrically loaded when this arrangement is used, and he therefore recommends having a number of these triple transformers each with its independent load on the secondary and distributing the lighting among these, connecting the primaries to the networks, so that the more heavily loaded of the three primary circuits are distributed among the three primary circuits in such a way as to counterbalance each other; the dynamo and feeders will then be more evenly loaded and the unsymmetrical loads will only be on the branch mains leading to the transformers. (It seems that this is precisely the same arrangement as was illustrated and described in the Digest, Jan. 28.)—*Elek. Zeit.*, Oct. 12.

Experiments With a Converter.—PICHELMAYER.—An illustrated account of experiments made with a converter for changing three-phase into continuous currents. The machine was used in some experiments as a converter and in others as a mechanically-driven three-phase current generator. The results are summed up as follows: For all three-phase current generators and converters with many slots, it is sufficiently accurate to assume that the voltage curves are sine curves, both for no load and for a load, as long as they are not influenced by other machines driven in combination with the former. The fact that in the experiments, the ratio between the voltage of the continuous current and that of the three-phase current for no load and for load, changed slightly whether the machine was used as generator or as converter, proves that the effective voltage of the three-phase current is influenced only slightly by the deformation of the field, provided the whole number of the lines of force of the field, measured by the voltage of the continuous current, is the same. This conclusion is correct only for machines with many slots. In the theory of the armature reaction of three-phase machines, it is not to be recommended to geometrically combine the main field and the armature field, but it is better to combine the e. m. fs. induced by these fields, because the curves of these e. m. fs. are much more nearly sinusoidal than the fields themselves. Continuous current machines, converters for changing three-phase into continuous current, and three-phase generators with many slots, can be treated in the same way with reference to the armature reaction. There is a much greater difference in this respect between a single-phase generator and a three-phase generator, than between a continuous current machine and a three-phase generator; in the three-phase generator the m. m. f. of the armature current is more or less constant, while in the single-phase generator it is pulsating. The addition of the curves of the continuous current generated, and of the alternating motor current consumed, which is assumed in the theory of the converter, is in agreement with the experiments. In the calculations of converters it is sufficiently correct to assume the waves to be sine waves whenever the primary current and voltage are sine waves.—*Elek. Zeit.*, Oct. 5.

REFERENCES.

Friction of Induction Motors at No Load.—BRAUN.—After a brief description of some other methods of measuring the friction loss in

induction motors at no load, he develops a simple formula for calculating this loss quickly from the effective power of the motor if loaded, the slip at the same load and the slip at no load. The formula seems to be of a practical nature, but is too complicated to be given here. Some examples, with diagrams, are added.—*Elek. Zeit.*, Sept. 28.

Continuous Current Generator.—A general description, with illustration, of a new moderate speed four-pole generator of the British Thomson-Houston Co.—*Ind. and Iron*, Oct. 6.

Dynamos.—GUILBERT.—Brief illustrated descriptions of recent improvements, taken from patent specifications.—*L'Eclairage Elec.*, Sept. 30.

LIGHTS AND LIGHTING.

REFERENCES.

Arc Lamps.—RICHARD.—A continuation of his well illustrated article mentioned in the Digest, March 4, giving numerous brief descriptions of improvements taken from patent specifications.—*L'Eclairage Elec.*, Oct. 7.

Arc Lamps.—LEHMANN-RICHTER.—A statement of the results of observations on constant current arc lamps, the variations in length of arc, current strength and voltage are given, showing the method of working and the importance of a system of regulation.—*Elek. Rundschau*, 16, p. 42; noticed briefly in *Science Abstracts*, October.

Train Lighting.—AUBERT.—A long, illustrated English translation of the article abstracted in the Digest, Oct. 7.—Lond. *Elec.*, Oct. 13.

POWER.

Electrical Engineering in Switzerland.—Some comments comparing Swiss and English practice in the form of impressions received by various members of the English society who recently visited Switzerland. An anonymous correspondent speaks of the general adoption of the design of the Niagara alternators with fixed internal armature, thus giving a maximum flywheel effect with a minimum weight and with the centrifugal force partly counteracted by the magnetic attraction; the high pressure transmission without transformers is also of special interest. All seem to agree on the intelligence of the Swiss workmen, the excellence of technical training, the great advantage of polyphase working and high pressure transmission; also the freedom of the industry from vexatious restrictions. J. N. C. Kennedy (a telegraph engineer) thought the telephone arrangements were not as good as the English; there were few trunk lines and their construction was bad. Where telegraph lines cross high-tension overhead circuits, they pass beneath, and guard wires were unnecessary, as it was assumed that the heavier wires would not fall. Threlfall thought the manufacture of electrical machinery was much more developed than in England; the design of the machinery is uniformly good, but the construction often lacked finish. Kensit called attention to the failure to govern high speed turbines satisfactorily, as in many cases the constant attendance of one man to each machine was necessary for this purpose, and even then there was a variation of voltage of 10 to 14 per cent. Great care is given to the design of switchboards and the arrangement of cables in stations; he was also struck with the order and cleanliness of the stations. S. P. Thompson tersely gave the lessons which he learned from the Swiss trip; he concludes that the use of continuous currents is to be avoided as far as possible except for electrochemical purposes, the alternating currents being preferable for all other purposes, including railroads; that the three-wire system with continuous currents "is played out;" that transforming up "has gone out of fashion;" that the space behind switchboards ought to be much greater than that in the front; that Swiss manufacturers have fewer prejudices than British; that more importance is placed on the technical education of the draughtsman than in England.—*Lightning*, Oct. 12.

Electric Auxiliary Machinery in the Navy.—ADAMS.—A long article in which he calculates the saving in weight and cost of operation, if for each small auxiliary steam engine on board ship, an electric motor of equal capacity is substituted and enough electric generators, direct connected to compound engines, are installed for the maximum demand at any one time. He gives estimates of the weights and finds the following results for a ship plant to deliver 1200-hp to auxiliaries aggregating a total of 2400-hp. At the government limit of 248.6 lbs. per hp output from dynamos and generating sets, the total weight of engines and dynamos to deliver 1500-hp is 372,900 lbs., the total weight of electric motors is 240,000 lbs., hence the total weight of the electric equipment is 612,900 lbs. As the total weight for steam driving for 2400-hp is 300,000 lbs., there is an excess of 312,900 lbs. of the electric equipment over steam engines. There is, however, a saving of the electric over the purely steam drive of 80 lbs. of steam per hour for each hp delivered to auxiliaries, hence an hourly saving of 96,000 lbs. of steam for 1200-hp. Taking this into account, he finds that the weight of steam driving of 2400-hp capacity is 300,000 lbs., the extra weight of boilers required is 480,000 lbs., the extra weight of feed water 96,000 lbs., hence the total weight for steam driving not required in the electric is 876,000 lbs. As the total for electric driving was found above to be 612,900 lbs., there results a saving in weight by electric driving of 263,100 lbs. Furthermore, the weights given for the electric system are based on those common in land plants, and it is by no means necessary or desirable to use such heavy machines on board ship as the present navy regulations allow. He considers the improvements now attainable in this direction and finds a saving in weight by electric driving of 498,000 lbs. The total cost for electric equipment is $185,000, for steam equipment $106,000; hence the additional cost of electric equipment, $79,000. The cost of fuel for the steam system is $345 per day more than that for the electric system, or $125,925 per year, so that the extra cost of the electric installation can be paid for out of the coal saved in 7½ months. In spite of the great advantages in weight and efficient operation inherent in the electric system for warships, the navies of the U. S. and of the world are slow to avail themselves of it. In most cases the electric system is confined to a few of the less important auxiliaries. To illustrate how generally steam is still used to drive battleship auxilaries, the U. S. battleship Iowa is cited. The net result with the electric equipment, all other things being equal, is said to be a lighter ship or greater coal capacity, a greater steaming radius or higher speed, and for ordinary operations in times of peace a material reduction in the yearly expense for coal.—*The Engineer*; reprinted in *Sc. Amer. Sup.*, Oct. 21.

Electricity in the U. S. Navy.—An abstract of the annual report of the chief constructor of the U. S. Navy, Rear Admiral Hichborn. In regard to the use of electricity it is said that electric motors are especially economical where intermittent power is required at varying intervals. Other things being equal, it is said to be a question still unsettled whether the weights of an electrical equipment will overbalance a steam auxiliary. "It is feared in some quarters that it may, and thereby necessitate sacrifices in such important elements in our ships as speed, armament and protection. It is supposed that the inefficiency of the proposed new cruisers of the Denver class may be due in some measure to the electric auxiliary idea having been pushed too far."—*Sc. Amer.*, Oct. 28.

Power Distribution in Factories.—An editorial discussion. Electrical distribution is acknowledged to be superseding the use of shafting and belts. The most economical system is to use a separate motor with each machine, except when they are very small as with sewing machines, but even then it is not advisable to use units larger than 4-hp. High speed motors are preferred on account of the first cost; a gearing with a rawhide pinion is considered the best to use; a machine should be used with gearing or belts, according to which it is built for, and it should not be used with the other. In factories only enclosed motors should be used. For over 100-hp steam power is probably the cheapest, but gas engines are sometimes preferable.—Lond. *Elec. Rev.*, Oct. 13.

REFERENCES.

Transmission and Distribution of Alternating Currents.—LEBLANC.—This continuation of his very long illustrated paper (Digest, Oct. 14) has two appendices; in the first he calculates a 300-kw machine for converting alternating currents at 2000 volts into continuous currents at 550 volts; the second is a description and calculation of a special booster for redressing transformers.—*Bul. Soc. Int. des Elec.*, August, October.

TRACTION.

Electric Railway Practice in Germany.—MAGEE.—A long, illustrated article containing a good description of German practice, by the managing director of one of the great manufacturing companies of Germany. The ownership of German tramways is discussed at length and the relationship of the great financial syndicates or groups to the tramway industry is set forth, and the influence which these groups have had upon the rapid development of Germany can hardly be overestimated. The chief peculiarity of German practice as dis-

tinguished from American is in the use of the mixed system of electric traction, by which the cars are propelled in the centre of the cities by storage batteries and on the outskirts by the overhead wire system. Another thing which Germany does which is not done to anything like the same extent in America or elsewhere throughout the world, is in the building of ornamental poles, combination trolley and lighting posts, etc. Details of practice in the matter of power stations, track, overhead construction, rolling stock, etc., are described, and it is evident that Germany has brought the science of electric tramway engineering to a high stage of development.—*St. R'y Jour.*, October.

Electric Railway Practice in Argentina.—MANVILLE.—An illustrated article in which are described the conditions under which tramway concessions are obtained in Argentina, and the physical and other problems to be overcome. There is considerable reluctance to granting long-time franchises in Argentina, and the companies are decidedly under the control of the municipality, which imposes a tax of 6 per cent. on the gross receipts for the maintenance of paving of roads in which the tramways are situated, and places other burdens upon tramway companies which are heavy though not prohibitive. Three kinds of roadbed construction are used, according to the traffic. In one, the rails are supported on complete concrete base, another on longitudinal concrete sleepers, and in the third on simple cross ties without concrete. In the distribution system, the maximum allowable fall of potential is very small, this result being brought about by the use of negative boosters, while the positive feeders leading to the extreme ends of the system have positive boosters. The overhead construction and underground feeder system in Argentina is excellent and the rolling stock is also good. Power is obtained chiefly from the local power stations, of which there are several working on a large scale.—*St. R'y Jour.*, October.

Electric Railway Practice in Austro-Hungary.—ZIFFER.—A long, illustrated article. The first electric railway in Austria for passenger service was opened in 1883 and was 4-km in length; that in Hungary in 1889; the latter was built on the underground conduit system. This conduit is used extensively in Budapest, and is being installed in Vienna; the trolley system, however, is in general use. Franchises are issued by the general government to private companies, but their life is limited to sixty years. Municipalities also have the right to build and operate street railways. He gives a list of the electric railways, with the average length, the gauge, the passengers carried and the receipts. The rails in the cities are laid either on concrete or broken stone to a depth of 30-cm, and weigh from 34 to 43-kg per meter. Outside of the city limits Vignole rails, from 21 to 23.5-kg per meter are used on wooden or metal ties. The practice in rail bonds, feeders and poles are described. The trolley wire is usually hard drawn copper, from 7 to 8.25-mm in diameter. The Baden-Boslau uses silicon-bronze wire, 7-mm in diameter. In some cases the top of the trolley wire is covered by a wooden protector, held in place by metal clamps, to prevent fallen telephone and telegraph wires from making contact. The most popular car is the so-called Hamburg type, with a long platform at each end, and a seating capacity of 20 passengers. The length over all is 8.4 meters. In smaller cities the cars vary from 5.8 to 7 meters in length over all. The writer then describes the different types of current collectors or trolleys. The speed in all cases is prescribed by the authorities, and is usually 15-km per hour; in the suburbs a speed of from 25 to 30-km per hour is permitted. Most of the large power stations operate condensing and use direct-connected units. The boilers are of the water tube type, and the consumption of coal per kw-hour varies from .8 to 5-kg. Economizers are sometimes used, and feed water heaters are always used. The industrial and mining roads are described briefly.—*St. R'y Jour.*, October.

Electric Railway Practice in America as Exemplified in Chicago.—A very long, well illustrated description of the surface railway systems of Chicago which are operated by ten independent companies, and the elevated railway system by five. Several of the principal lines are still running by the cable system, but the greater part of the mileage is now electric, and it is intended as soon as possible to change the cable lines over to electric. Horse railways have nearly disappeared from Chicago. The elevated lines are all operated by electricity, forming by far the largest electric elevated system in the world. Descriptions and illustrations of a large number of power stations are given, and they are also shown diagrammatically to scale in such a way that the relative sizes of the stations may be readily seen. Nearly all the large power stations are run non-condensing, there being only three or four condensing stations in the city. The inability to get a sufficient supply of water at a reasonable rate has led to the use of cooling towers and tables, by which the water for condensation is used several times. The roadbed of Chicago, while not particularly admirable, is still worthy of attention, and particularly with regard to the cast-welding of joints, which has been brought to a high state of perfection there. The overhead construction is very good, though simple, and less thought has been given to ornamentation than to unobtrusiveness in the streets. A description of the construction methods used in the new Northwestern Elevated, with illustrations, closes this article.—*St. R'y Jour.*, October. A long illustrated description of the street railways in Chicago is also given in the *St. R'y Rev.*, Oct. 15.

Steep Grade Line at Laon.—A brief illustrated description of this short steep grade line in France constructed by the French Thomson-Houston Co. It is 1.5-km in length, has three cars and rises 100 meters in a length of 1.2-km, which is an average grade of 8.1 per cent.; there are also grades of 10 and 13 per cent. Notwithstanding these grades, the line is worked entirely by adherence alone, although there is a rack and pinion on a large part of the line. The ascent is made in 6.5 minutes. This is said to be the first line of such a steep grade on which adherence is used. The voltage is 500, the gauge 1 meter, and a car will carry 26 passengers. A profile of the line is given.—*L'Elec.*, Oct. 7.

Relation Between Number of Inhabitants, Earnings and Car Miles.—HECKER.—A long French abstract, with tables and formulas, of the article noticed in the Digest Sept. 16. The formulas are tested on six French cities chosen without bias, and the agreement is only approximate; in general, the values are larger than the calculated; in one case, that of the car miles of Rennes, the statistical value is 60 per cent. larger.—*L'Eclairage Elec.*, Oct. 7.

Surface Contact System.—An illustrated description of a contact system devised by Merriman. The flanges of the car wheels press a treadle and thereby depress the lower arm of a lever, so that the longer arm rises, carrying with it the contact stud. After the car has passed, the heavy longer lever arm with the contact stud falls back again so that the stud is only raised, and consequently alive while the car is actually passing.—Lond. *Elec. Eng.*, Oct. 13.

Disturbing Effects of Railways on Galvanometers.—BLASERNA.—A brief abstract of his Como Congress paper. Since the electric railway in Rome, which passes within 200-m of the observatory, has been constructed, accurate readings on galvanometers are impossible as the disturbing effects are 20 to 30 times larger than the error of observation. Marini studied the effects in Rome and other places, and concludes that the use of alternating currents is a complete remedy; continuous currents in the overhead line produce the most serious effects; the effect is felt up to a distance of 300-m, and is produced not only by the overhead current but by the rail and earth return currents also; with accumulators the limiting distance is about 30-m, and therefore these are permissible; in other cases the road should have a double overhead line and not use the rail return. He recommends that the authorities should prevent electric railroads from affecting physical institutes; to this Kapp and others objected on the ground that it would unjustly limit the development of electric railroads.—*Elek. Zeit.*, Oct. 12.

Automobile Motor.—GASNIER.—A full account with curves and data of an automobile motor made in France which it is claimed compares very favorably with similar data of an American motor. The weight is 86-kg and the normal power 2400 watts at 30 amperes, 80 volts and 1100 revolutions; the efficiency is above 80 per cent. between 700 and 3000 watts and 84 per cent. between 100 and 1600 watts. It has four poles of soft steel, two of which are wound and two are consequent poles. The results of tests which are described, show that the losses are as follows: Brush friction 74.2 watts, bearing friction 12, hysteresis 41.6, Foucault currents 37.6, total 165.4 watts; the loss due to brush friction is therefore nearly half of the total. The application of the motor to a carriage is to be described in a subsequent article.—*L'Ind. Elec.*, Oct. 10.

REFERENCES.

India.—An abstract from a consular report on the street railway system of Bombay, on which electricity is soon to be used.—*Elec. Rev.*, Oct. 18.

Competition of Heavy Automobiles.—A brief outline of the programme for the competitive tests of types of automobiles for carrying heavy weights.—*L'Elec.*, Oct. 7.

Automobile Bicycles.—BERTHIER.—An illustrated description of

various automobile bicycles, some of which are electric.—*Cosmos,* Oct. 14.

Automobile Accumulators.—Bainville.—A continuation of his illustrated report of the prize competition for automobile accumulators, arranged by the Automobile Club of France (Digest, Oct. 14). The measuring instruments and the methods of measurements during charge and discharge are described. A table gives the results for the ninth to the twelfth week of the tests.—*L'Elec.,* Oct. 14.

Installations, Systems and Appliances.

Llandudno.—An illustrated description of the municipal lighting plant at this watering resort. A 440-volt three-wire system is used, with a balancing battery and a balancing machine. The chief feature of the generating plant is the use of refuse destructors. There are two dynamos of 100-kw at 440 to 500 volts and a 50-kw dynamo at 600 volts. The battery consists of 256 cells, giving 50 amp. for ten hours or 200 amp. for one hour, the average output being 90 amp. After 11:45 p. m. the whole current is supplied from the battery.—Lond. *Elec. Rev.,* Oct. 13.

Alderley and Wilmslow.—A well illustrated description of this new, small English lighting plant. Two dynamos furnish current at 420 to 460 volts for a 2 × 210-volt three-wire system, a balancer and a battery taking care of the balance of the system, the cells being charged directly from the bus bars through boosters. The battery consists of 230 cells, having a capacity of 750 lamps of 8-cp for nine hours or 1100 lamps for four hours.—*Lightning,* Oct. 12; Lond. *Elec.,* Oct. 13.

200 Volts Electric Light Installation.—A note stating that the work of changing over the consumers of the City of London Electric Lighting Co., from the 100 to the 200 volts mains is going on. New lamps, and where necessary, new fuses and lampholders, are put in by the company at their own expense.—Lond. *Elec.,* Oct. 13.

Fuse Switches.—Stadelmann.—An illustrated description of a system of fuses, each provided with a switch, and so arranged that the branch circuits can be readily thrown over from one side of a three-wire circuit to the other at the fuse, or from one phase of a three-phase circuit to another. The switch is in effect a mere link bolted at one end and capable of being pushed under a screw at the other, the fuse being placed equally distant between the two mains.—*Elek. Anz.,* Oct. 12.

Switches.—Baxter.—In a continuation of his illustrated article (Digest, Oct. 28) he describes switches in which the objection of the quick break is obviated and at the same time the switches are protected from the destructive action of prolonged sparks, which is accomplished by two sets of contacts, one of copper, and the other of carbon blocks. These switches, however, are rather bulky and more liable to get out of order than the plain type, so that their use now is limited. As switches on switchboards are not opened very often, the effect of sparking is in general not serious. He discusses the construction of switch contacts, several forms being illustrated, and describes automatic switches, operated by a magnet.—*Amer. Mach.,* Oct. 26.

Electricity on Canals.—An illustrated article on electric installations on canals in Germany. In Emden, at one end of the canal from Dortmund to Emshafen, a central station supplies continuous current at 500 volts for power, and at 2 × 220 volts for lighting; when completed it will contain three sets of machines, each of 100-hp, two sets having been already erected. An accumulator battery serves for subdividing the voltage for lighting and as a buffer battery. Cranes and pumps are operated electrically, and all the work at the locks is done by electricity. The system of electric canal boat towing, referred to in the Digest July 22 and Sept. 2, is also described.—Lond. *Elec. Rev.,* Oct. 13.

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Coblenz.—An illustrated French abstract of the German description noticed in the Digest, Oct. 7. The plant is a municipal one and supplies power for both lighting and traction.—*L'Ind. Elec.,* Oct. 10.

Berlin Central Station.—The beginning of an illustrated description of the present extension. In this part the three new 3000-hp steam engines are described.—*Zeit. f. Beleucht.,* Oct. 10.

Determining the Proper Price for Alternating Currents.—Benischke.—A long illustrated French abstract of his paper, noticed in the Digest July 22.—*L'Eclairage Elec.,* Oct. 7.

Electro-Physics and Magnetism.

Theory of the Voltaic Contact.—Majorana.—An abstract of his Como Congress paper, which seems to be the same as the one abstracted in the Digest Sept. 30. According to the author every metal has a certain potential and when two different metals are approached to each other there will be a difference of potential even if they are not in contact. He constructed an apparatus in which this difference of potential generated a current, though only a very small one. In the discussion his conclusions were questioned by Pacinotti and Righi; S. P. Thompson also doubted that an e. m. f. is produced by contact, as the tests only showed that when metals are approached an e. m. f. is produced; at contact, he claims, it disappears again; he thinks that in these tests it is a voltaic cell that produces the effect, air being the electrolyte.—*Elek. Zeit.,* Oct. 12.

Propagation of Electric Oscillations in Dielectrics.—Turpain.—A paper read before the French Society for Advancement of Science. After an outline of the theory of Maxwell and that of Helmholtz and Duhem, he gives an account of the experimental researches of Blondlot, Arons and Rubens, and Cohn and Zeeman, which seem to be contradictory. He then gives the results of his own experiments which show that this contradiction is only apparent and that all researches may be regarded as agreeing with the theory of Helmholtz and Duhem. A description of his experiments is promised.—*L'Eclairage Elec.,* Oct. 7.

Discharges of a Condenser.—Roiti.—An illustrated account of experiments in which he discharged a condenser through a Röntgen tube and an air gap, both circuits containing self-induction coils which could be adjusted. If the conditions of the experiments were varied, either the Röntgen tube was illuminated or sparks were obtained through the air space, but in general both discharges did not occur at the same time. Theoretical explanations are given.—*L'Elettricista,* March; abstracted in *L'Eclairage Elec.,* Oct. 7.

Cathodic Reverser.—An illustrated description of vacuum tubes which allow the current to pass only in one direction. One electrode is placed in the narrow part of the bulb and offers an enormous resistance as cathode, the other, a spiral, placed in the opposite wide part of the bulb, permits the negative electricity to pass readily.—*La Nature*; abstracted, with illustrations, in *Sc. Amer. Sup.,* Oct. 28.

Hittorf's Dark Space.—Ebert.—An account of an experimental investigation of the dark space found by Hittorf, immediately adjoining the luminous layer covering the cathode, which increases in thickness when exhaustion proceeds. He found that if the current is kept constant in air and some other gases this dark space increases in a geometrical series as the pressure decreases in another geometrical series, the coefficients being different.—*Wied. Ann.,* No. 9; abstracted in Lond. *Elec.,* Oct. 13.

Canal Rays.—Ewers.—An account of experiments with canal rays, from which he concludes that they consist of positive ions of the material of the cathode, the matter thus conveyed to the walls being exceedingly small.—*Wied. Ann.,* No. 9; abstracted in Lond. *Elec.,* Oct. 13.

Mutual Induction of Coaxial Helices.—Lord Rayleigh.—An abstract of a British Association paper. From the general theory of lines of force he reaches the conclusion arrived at by Jones, from Neumann's formula, that the coefficient of mutual induction between a circle and a coaxial helix is the same as between the circle and a uniform circular cylindrical current-sheet of the same radial and axial dimensions as the helix, if the currents per unit length in helix and sheet be the same.—Lond. *Elec. Eng.,* Oct. 13.

Earth's Magnetism During Ancient Times.—Blaserna.—An abstract of his Como Congress paper, the former journal containing also the curve of the magnetic inclination in Italy from 800 B. C. to 100 A. D. It is a summary of the researches of Folgheraiter, which have frequently been noticed in the Digest, and in which the magnetic inclination during various centuries was measured by the inclination of the magnetic axes in earthen vases which were made during those times; it is applicable only to measuring the inclination but not the declination; but it is suggested to measure the latter by making similar examinations of bricks taken from ancient buildings which have been destroyed by fire. A large number of vases whose ages were known, were measured and the results seem to agree very well; they show that in the seventh century B. C. the magnetic equator passed through Rome and central Italy. It is also suggested to use this method for determining the age of vases in case of doubt.—*L'Ind. Elec.,* Oct. 10; *Elek. Zeit.,* Oct. 12.

Magnetic Shielding.—Wills.—A theoretical discussion extending the investigations of Ruecker and Du Bois which have shown that concentric shells separated by non-magnetic interspaces give a better magnetic shielding effect than extremely thick single iron shells. He deduces analytically the general explicit formulas giving the shielding effect of trilamellar, spherical and cylindrical shells under cer-

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tain conditions in such mathematical form as to be readily interpreted, and applies his results in the graphical discussion of a particular problem showing the great advantage to be gained by introducing suitable air gaps within the shielding material.—*Phys. Rev.*, October.

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Residual Luminosity of Vacuum Tubes.—SANDRUCCI.—A French abstract of his article noticed in the Digest July 22.—*L'Eclairage Elec.*, Oct. 7.

Velocity of Waves Along Wires.—GUTTON.—A translation of the article noticed in the Digest Sept. 23.—*Elec. Rev.*, Oct. 18.

Confirming Ampere's Hypothesis.—NIKOLAIEVE.—A French Academy note describing experiments confirming this theory concerning the direction of the elementary electromagnetic action; he uses a hollow revolving magnet.—*L'Ind. Elec.*, Oct. 10.

Atmospheric Electricity.—CHAUVEAU.—An Academy note on the diurnal variations of atmospheric electricity; it gives the results of the researches which have been carried on during eight years on the Eiffel tower and at the other observatory near Paris.—*L'Ind. Elec.*, Oct. 10.

ELECTRO-CHEMISTRY AND BATTERIES.

Plant for the Production of Alkalies, in Clavaux.—KERSHAW.—A short description of the Hulin process which has been in commercial operation in this French plant from 1894 to 1897. It consists in the electrolysis of a fused mixture of chlorides of lead and sodium with an anode of carbon and a cathode of fused lead. Chlorine is formed as gas, while the sodium ions travel to the lead cathode and form with it an alloy of sodium and lead; from this alloy the sodium is then recovered as soda, and the lead in the spongy form. To make the process continuous a lead anode is used in conjunction with the one of carbon, a fractional part of the current being led through it. A comparison of the Hulin process with others is given. The disadvantages are, less efficiency of current and energy and less quantities of sodium and chlorine obtained. As advantages the following are stated: A strong current can be used, so that the quantity of sodium obtained per surface of cathode is about 30 times greater than in the other processes; valuable by-products, such as spongy lead and peroxide of lead are obtained in a simple and cheap way; strong solutions of the caustic can be obtained free from chloride of sodium, by simple lixivation of the alloy of lead and sodium without special concentration.—*Elektrochem. Zeit.*, September.

Electrochemical Industry.—LUNGE.—An abstract of a paper on impending changes in the general development of the industry, with special reference to the alkalies, read before the Liverpool section of the Society of Chemical Industry. He dealt chiefly with the utilization of water power, especially in Switzerland, and of electrolytic processes for the manufacture of chemicals. He questioned the accuracy of some of Borcher's statistical data (Digest, Aug. 26), but agreed that the new electrolytic chemical processes were destined to supersede the old Le Blanc process of manufacture and that in time all the chlorine products of the world would be made by electrolysis.—*Lightning*, Oct. 12.

Electrolytic Extraction of Mercury.—A short and indistinct description of a process. The raw material, cinnabar, is crushed to a fine powder and then treated with a hot solution of sodium sulphide containing caustic soda. The electrolytic vats are of iron, and may be used as cathodes; the anodes are of sheet steel. It is stated that the mercury can be readily separated from the upper part of the cell, and is enriched with equivalent amounts of copper, silver, zinc, cadmium, nickel and iron in the lower compartment of the cell (but what this means is not clear). The solution on issuing from the cell is then passed through a series of vessels, in which the silver is displaced by copper by simple chemical action. It is not possible to remove the last traces of silver by this method, but the amount found in the deposited copper should not exceed 0.03 per cent. when the process is working satisfactorily. After "passing through a series of the sulphide solution by using a current of" 0.03 to 0.05 amp. per square inch at 2 volts, the electrolyte can be used again for extracting fresh ore after the addition of sulphur.—Abstracted in *Eng. and Min. Jour.*, Oct. 21, from the *Jour. Soc. Chem. Ind.*

Production of Metallic Solutions by the Electric Arc.—BREDIG.—An abstract of a paper describing a method of producing metallic solutions by the electric arc, based upon the phenomenon of the pulverization of metallic cathodes (see Digest, Aug. 26). He obtained beautiful purple or dark blue auriferous solutions by forming an electric arc in water between two gold wires, the voltage being 30 to 40, the current 6 to 10 amp.; the addition of a little potash is to be recommended. Auburn metallic solutions are obtained by forming an electric arc in water between silver and platinum wires.—*Elektrochem. Zeit.*, September.

New Processes in the Sugar Industry.—A description of a method of purifying the liquors, syrups, etc., by a preparatory chemical treatment followed by electric dialysis. The applications to the manufacture of cane sugar and to sugar refining are discussed. A method is also described for obtaining hydrous sulfurous acid by electrolysis with liquids containing sugar, insoluble electrodes being used and sulfurous acid being added to the solution. It was found that hydrous sulfurous acid is stable only at temperatures below 40° C. The voltage should be below 6.—*L'Ind. Elektrochim.*, No. 4, p. 42; *Elektrochem. Zeit.*, September.

Rectifying Alternating Currents With Aluminium Cells.—BATELLI.—A brief abstract of his Como Congress paper. It gives the results of experiments to determine the best electrolyte to be used. He found this to be a nearly saturated solution of the double salt of chromium and potassium; with this the time of polarization is only one-fortieth to one-fiftieth of a second and the counter e. m. f. is 65 volts per cell; the researches were made at various frequencies, mostly 25. The distance between the electrodes seems to have no effect within rather large limits, but the current density is important. The best results were obtained with 0.3 ampere per sq.cm. —*Elek. Zeit.*, Oct. 12.

Rotating Ozonizer.—MARESCHAL.—An illustrated article on the industrial production of ozone describing Otto's rotating ozonizer. The effluvium is produced between two parallel series of plates mounted on two concentric cylinders. The inner cylinder is rotating and whenever one series of plates is just opposite to the other, a strong effluvium passes, the formation of arcs being prevented by the rotation.—*La Nature*, Oct. 14.

Impurities in Electrolytic Aluminium.—MINET.—An article stating that the impurities of electrolytic aluminium consist in general of silicum, iron and traces of carbon, and they amount to not more than 0.0015 of the metallic mass, the carbon electrodes being the source of the silicum and the trough that of the iron. Three methods are described for reducing the amount of iron. The last is to cover the inner surface of the metallic trough with a thick layer of carbon, which is not in circuit, the bath being kept fused by the current only. For a long time there will be no action on the trough and the carbon cover. If the carbon layer is thick enough and the external cooling great enough, so that the temperature of the trough does not exceed 500°, the trough can be made of aluminium and the metal obtained then has as impurities only traces of silicium.—*Comptes Rendus*, v. 128, p. 1163; abstracted in *L'Ind. Elektrochim.*, August.

Sodium in Electrolytic Aluminium.—According to Moissan the different chemical behaviors of various specimens of aluminium are due to the different compositions of the aluminium, that is, to the impurities contained; in samples from various manufactures he found different quantities of sodium varying from 0.1 to 0.3 per cent. —*Kraft. und Licht.*, No.22, p. 220; abstracted in *Elektrochem. Zeit.*, September.

Vuillot Process for Forming Accumulator Plates.—A description of this process which is to be used in a projected accumulator manufacturing plant in Brussels. In order to form spongy lead Vuillot subjects lead plates to the action of carbonic oxide, whereby more or less of the material is changed into carbonate of lead, and then brings them as electrodes into an alkaline bath, such as a 5 per cent. ammoniacal solution. After having been exposed for a few hours to electrolytic action, a complete reconversion of the carbonate of lead has taken place; at the negative plate it is transformed into spongy lead, while at the positive there is said to be formed a hard and uniformly wrinkled skin of oxide of a closeness and consistency approximating that of the original plate.—*Elek. Rundschau*, No. 19; *Elektrochem. Zeit.*, September; Lond. *Elec.*, Oct. 13.

Some critical editorial notes are added to the description in the Lond. *Elec.* It is said that the same process may be applied to a plate made of salts of lead produced artificially or mechanically, as in the Faure process. The trace of alkali which the plates must contain will probably prove beneficial at first, but it may soon be used up, and then there is left the old lead—lead peroxide couple with its familiar faults. It is pointed out that a new couple is wanted, or the discovery of some substance whose addition to the old couple will neutralize the deleterious bodies formed during the working of the cells; and this substance must be one which can be broken up and reformed continuously during charge and discharge so that the working of the cell may be continuous.—Lond. *Elec.*, Oct. 13.

Dry Batteries.—An article discussing the practical limitations of dry batteries. If the volume in cubic inches of any dry cell is given, it is said that a continuous current of more than one milliampere per cubic inch cannot be obtained without a rapid fall in e. m. f., but at this rate an average total amount of energy in watt hours equal to about 1.1 times the total volume in cubic inches may be obtained from each cell before the e. m. f. falls to 1 volt. Currents much in excess of 1 milliampere per cubic inch require very long intervals of rest. Dry cells can be used for small voltage lamps efficiently only for very short periods, with long intervals of rest; they are, however, very useful for electric bells. Two diagrams show the fall of e. m. f., if a constant current of 1 milliampere per cubic inch is taken from the cell. The e. m. f. falls from 1.467 to 1.420 volt during the first six hours and to 1 volt during about 50 days.—Lond. *Elec. Rev.,* Oct. 13.

Gas Batteries.—Some editorial notes on the use of gas batteries instead of lead accumulators for automobiles and other purposes. Whether they can compete successfully can only be found by commercial use. A new and exceedingly light gas battery, constructed by Germain, an inspector of telegraphs in France, is briefly described. An airtight vessel contains pairs of porous carbon discs, separated by cellulose or paper pulp, the whole being tightly compressed. The pulp is moistened with dilute sulphuric acid, and oxygen and hydrogen gas are led by means of pipes to the centres of alternate discs respectively, so that when the latter are suitably connected, an electric current is obtained. No data is given.—Lond. *Elec.,* Oct. 13.

Potential Differences Between Metals and Fused Salts.—GORDON.—An account of measurements of the e. m. fs. of cells, containing fused nitrate of silver dissolved in a mixture of fused nitrate of potassium and nitrate of sodium, silver electrodes being used; one of these solutions contained more nitrate of silver than the other. The potential difference at the contact plane of the two solutions can be assumed to be zero for those high temperatures; what is measured is, therefore, the sum of the two potential differences between the electrodes and the two solutions, which can be found theoretically from Nernst's formula. For small concentrations of the nitrate of silver the measured values agree well with the calculated, so that the dissociation (which is an assumption in Nernst's formula) is complete. For more concentrated solutions the measured and calculated values disagree and from the differences between both values the degree of dissociation can be calculated. It is 0.69 for a fused solution containing 50 per cent. by weight of nitrate of silver and 0.58 for pure fused nitrate of silver at 236° C.—*Zeit. fuer Phys. Chemie,* v. 28, p. 302; abstracted in *Zeit. f. Elektrochemie,* Oct. 12.

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Preparation of Arseniuret of Calcium.—A short description of the method of Lebeau for producing arseniuret of calcium by treating a mixture of 100 parts of arsenate of calcium and 30 parts of carbon, in the electric furnace.—*L'Ind. Electrochim.,* August.

Action of Metals on Nitric Acid.—FREER and HIGHLEY.—An account of an investigation of the action of iron on nitric acid, and the effect of electrolytic hydrogen on it, using cathodes of copper, silver and lead.—*Am. Chem. J.,* v. 21, p. 377; abstracted in *Tech. Quart.,* September.

Dissolving of an Iron Anode in a Solution of Acetate of Sodium and Acetic Acid.—ARTH.—A description of some experiments showing that this is a very complicated phenomenon and that it does not always occur in the same way as described previously by Regnault.—*L'Ind. Electrochim.,* August.

Behavior of Chromium.—HITTORF.—A long French abstract of his German Elektrochemical Society paper noticed in the Digest July 30.—*L'Eclairage Elec.,* Oct. 7.

Production of White Lead by Electrolysis.—An account of various processes.—*Rev. Internat. de l'Elec.,* 17, p. 279; abstracted in *Elektrochem. Zeit.,* September.

Amphotere Electrolytes.—BREDIG.—A long French abstract of his German Elektrochemical Society paper noticed in the Digest Sept. 2.—*L'Eclairage Elec.,* Oct. 7.

Electrolytic Reduction of Organic Combinations.—PIERRON.—An article on the electrolytic reduction of the nitrate group. It is chiefly chemical in character.—*L'Ind. Electrochim.,* August.

Treatment of Oils With Ozone.—A description of a method of purifying linseed oil by conducting ozonized air through it. About 81,900 gallons of ozonized air are required for a ton of oil.—*L'Ind. Electrochim.,* No. 4, p. 46; abstracted in *Elektrochem. Zeit.,* September.

Chemical and Contact Theories.—COOPER.—The first part of a general line of the chemical and contact theories of galvanism. The most important researches which have been made in this direction, are described with the aid of diagrams.—Lond. *Elec.,* Oct. 13.

Electrochemical Industry in Europe.—A list of the principal electrochemical plants in Europe, arranged according to the countries and the materials manufactured.—*L'Ind. Electrochim.,* August.

UNITS, MEASUREMENTS AND INSTRUMENTS.

High Voltage Condensers.—LOMBARDI.—Long abstracts of his Como Congress paper. He showed by a numerical example the economy that can be realized by the use of high voltage condensers in cases of power transmission. Owing to the change in phase produced by transformers and motors the economy in transmission at certain times is very unfavorable, but by the use of condensers the evil effects could be counterbalanced. He shows that at a cost of $200 per microfarad for a condenser that can stand 10,000 effective volts, it would be remunerative to use condensers. He then discusses the construction and their cost. For high voltages it is better to use several condensers in series in order to reduce the thickness of the dielectric, and to provide each with a spark protector. The choice of the dielectric is discussed systematically and a table giving the various factors involved for different materials is given; it shows that gutta-percha, petroleum and glass must be rejected; also mica and ebonite on account of their high price; this leaves only paraffine and wax. The difficulty with paraffine is to get it in the form of thin sheets, and this he has overcome; he makes his condensers with such sheets. A condenser of two sections of 0.05 microfarad each, which can resist 10,000 effective volts, and was tested with three times this, is described and the weight of it is 22 pounds; the dielectric is a mixture of paraffine and other substances which increase the fusion point and make it more homogeneous. A condenser of 1 microfarad which will stand 10,000 volts, contains more than 220 pounds of paraffin, the cost of the material is about $70 and the cost of manufacture about an equal amount; at this cost the condensers become practical. An equivalent one made of wax will cost three times as much and of ebonite six times as much.—*L'Ind. Elec.,* Oct. 10; *Elek. Zeit.,* Oct. 12.

Condensers in Alternate Current Power Transmission.—LOMBARDI.—A paper developing the formulas for the variation of potential in circuits containing resistance, inductance and capacity, and giving the results of measurements of the properties of different dielectrics. The following four characteristic values are measured: The insulation resistance per unit of specific inductive capacity, the absorption of energy from leakage and hysteresis, the rapidity of polarization found by the ratio of the apparent capacities measured by continuous and alternating currents, and the maximum capacity which the dielectric can present per unit of volume for a given potential difference. These four values are for mica 7000, 0.000, 1.007, 42; for ebonite 700, 0.009, 1.021, 35; for paraffin 3000, 0.008, 1.021, 24; for gutta-percha 400, 0.042, 1.050, 28; for petroleum 20, 0.014, 1.7, 7; for window glass 2, 0.070, 2.3, 29. Taking the cost into consideration he concludes that the most suitable dielectric is paraffin, thoroughly free from air bubbles.—*Nuovo Cimento,* v. 9, p. 354; abstracted in *Science Abstracts,* October.

Measuring Instruments for Three-Phase Currents.—ARNO.—An abstract of a Como Congress paper, describing a simple method of measuring the angle of phase $\emptyset$ in an equally loaded three-phase system, with a wattmeter. If i is the current and e the e. m. f. in one phase, and the current coil of the wattmeter is in series with this phase, while the voltage coil is in parallel, being inserted between the phase terminal and the zero point, the wattmeter measures the power $ei \cos \emptyset$; if now the voltage coil is inserted between the terminals of the other two phases, the e. m. f. is $e\sqrt{3}$ and the angle of phase between this e. m. f. and the current in the first coil is $90°-\emptyset$, hence the wattmeter now measures $ei\sqrt{3} \sin \emptyset$. If it indicates in the first case A, in the second case B, then $\cot g\, \emptyset = A\sqrt{3} \div B$, so that the angle $\emptyset$ can be easily found by two readings, if a proper switch is provided to switch over the voltage coil quickly. (The principle seems to be exactly the same as in Babcock's method for two-phase currents, described in the Digest Oct. 28.) He furthermore describes a wattmeter with a rotating field and shows how any phase difference up to 30° in the wattmeter, may be eliminated by a certain switching of the voltage coil, which can be accomplished by using a ring with three coils for the three phases and branching several points off from one phase. In the same way an energy meter can be constructed. If the phase difference in the wattmeter is ex-

actly 30°, the induction ring with the three phases is superfluous. The briefly abstracted description of these instruments is somewhat involved.—*Elek. Zeit.*, Oct. 12; *L'Ind. Elec.*, Oct. 10.

Optical Electrometer for High Voltages.—POCKELS.—A description of an optical electrometer, based upon the fact that the double refraction of quartz is changed under the influence of an electric field, the lines of force of which are perpendicular to the main axis of the quartz crystal. This optical action occurs immediately upon the excitation of an electric field so that e. m. fs. of small duration can be measured, and it is proportional to the e. m. f. As the change of double refraction is dependent upon the sign of the e. m. f., the measurement of alternating current voltages is not possible.—*Mechaniker*, v. 7, p. 29; abstracted in *Zeit. f. Elektrochemie*, Oct. 12.

Wehnelt Break.—A brief illustrated description of what seems to be a well designed form recently brought out by Siemens & Halske. The platinum wire anode does not pass into the acid vessel laterally as usual, but enters from above through the lid, thus getting over the difficulty of a fluid tight joint; it passes through a vulcanite tube with a porcelain nozzle and the active length may be varied from zero to 20-mm by means of a screw which enables the frequency to be varied from a few to 1700 per second. There is a cooling arrangement which keeps the temperature down to 35° C. by the circulation of water. The coils are adapted to 220 or 110 volt mains without external resistance; the apparatus also works on alternating current circuits.—Lond. *Elec. Rev.*, Oct. 13.

Mercury Jet Interrupter.—LEVY.—A long illustrated description of an interrupter which belongs to that type of breaks in which a jet of mercury is directed against a rotating drum furnished with teeth. If the mercury jet makes contact with a tooth, the circuit is closed; if it passes between two teeth, the circuit is open.—*Elek. Zeit.*, Oct. 12.

Measuring Dielectric Constants.—COOLIDGE.—A modification of Drude's method to measure dielectric constants of bodies obtainable only in small quantities, which consists in introducing them into a small condenser in the resonant circuit of a Blondlot wire system and noting the effect upon the point at which resonance sets in. He has improved this method by introducing the condenser into the exciter circuit, which has the effect of considerably increasing the accuracy and sensitiveness of the method so that if the substances have no very strong tendency to absorb electric waves, the dielectric constants may be determined by this method with an accuracy of 0.1 per cent.—*Wied. Ann.*, No. 9; abstracted in Lond. *Elec.*, Oct. 13.

Metalloceramic Resistances.—A short article on electric resistances manufactured by Parvillee. They have high resistance and small volume and are formed of a mixture of a metallic powder with an insulating and refractory paste, such as porcelain-earth. The metal best adapted for this purpose is said to be nickel. Three rods, each 6.3 inches by 0.6 inch by 0.16 inch will carry 25 amperes at 110 volts. A plate 0.2 inch by 0.04 inch by 0.12 inch has a resistance of 100 ohms. (See also the abstracts of the articles by Fleming and Heraens, Digest, Aug. 19, 26.)—*L'Ind. Electrochim.*, Aug.

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Platinum Thermometry.—CALLENDAR.—A Brit. Ass'n paper giving some suggestions concerning the adoption of the platinum resistance thermometer as a practical standard.—Lond. *Elec. Eng.*, Oct. 13.

Properties of Condensers of High Capacity.—TOBLER.—A long French abstract of his article noticed in the Digest, Sept. 30.—*L'Eclairage Elec.*, Oct. 7.

Brit. Ass'n Small Screw Gauge.—The illustrated report of a special committee of the Brit. Ass'n appointed to consider means by which practical effect can be given to the introduction of the screw gauge proposed by the Ass'n in 1884.—Lond. *Elec.*, Oct. 13.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Pollak-Virag Telegraph System.—A note stating that this system, which was described in the *Elec. World and Eng.* of July 15, was tested on a line between Berlin and Budapest on Sept. 29, in the presence of officials of the German and Hungarian mail departments. The tests were very satisfactory. A message of 220 words was transmitted in nine seconds, and this speed is claimed to be below the maximum obtainable.—*Elek. Zeit.*, Oct. 12.

Selector Systems for Wireless Telegraphy.—COHEN and COLE.—In a communication they confirm Prof. Fessenden's remarks concerning the possibility of obtaining a selective system by means of synchronized commutators or other devices of that kind (see *Elec. World and Eng.*, July 29, Aug. 12, Sept. 16). The systems and types of selectors used for multiplex telegraphy, however, are said to be in the majority of cases unsuitable for working with Hertzian waves. The principal requirements for a selector to work successfully in conjunction with Hertzian waves, are said to be, first, a rate of decohering considerably higher than the rate of selecting; second, the synchronizing wave should preferably be sent out after every complete cycle and should be so arranged that it does not interfere with a signal sent out during the time of synchronizing. They have taken out patents.—Lond. *Elec.*, Oct. 13.

Locating Ships by Wireless Telegraphy.—In a communication it is pointed out that a ship can be located from two stations on the coast with the aid of wireless telegraphy, if rectilinear propagation of the waves can be assumed. It is only necessary to measure at either station the angle between the electric wave and the connecting line of the two stations; how he proposes doing this is not described.—Lond. *Elec.*, Oct. 13.

REFERENCES.

Wireless Telegraphy.—An illustrated article on the use of wireless telegraphy for the recent yacht races in New York.—*Sc. Amer.*, Oct. 28.

Wireless Telegraphy.—TROWBRIDGE.—A well-illustrated elementary description.—*Pop. Sci. Monthly*, Nov.

Telephone.—A note taken from the daily press stating that an Italian, Prof. Russo d'Assar, has invented a specially constructed telephone to prevent train disasters. The description is very poor, and no technical information is given.—*Elek. Anz.*, Oct. 8.

Multiple Telephony and Composite Transmission.—T. D. LOCKWOOD.—The first part of an illustrated paper read before the Association of Railway Telegraph Superintendents, in which he describes several forms of multiple telephony, arranged for simultaneous transmission of two or more telephonic messages over the same wires, and also of composite transmission of simultaneous telegraphic and telephonic transmission over the same wires at the same time. The descriptions are taken from patent specifications.—*Elec. Eng'ing and Tel. Mag.*, Oct.

MISCELLANEOUS.

Swiss Dynamos.—LAUNAIS.—Some short sets of statistics showing the exportation of dynamos from Switzerland in 1897, amounting to a total of over $1,600,000; in 1898 it was about $1,800,000; for the first half of the present year, it was nearly a million dollars. The tables give the exports to foreign countries; those to this country are very small. He thinks that good work is sacrificed for cheapness, and cites an illustration in which a head-race pipe collapsed from atmospheric pressure. French machinery is more expensive than the German or the Swiss, but he claims it to be much better.—*L'Ind. Elec.*, Aug. 10.

Electricity in India.—A note quoting from an article of Major Townshend stating that India presents a splendid field for electrical development in the near future. There are fine iron ores available in enormous quantities in Southern India, but they cannot at present be developed owing to the inferior quality and high cost of the coal. Many of the minor Indian waterfalls are practically dry except in the monsoon, so that it would be necessary to invent an accumulator capable of storing up 60,000-hp continuous for four months in the year and giving it out "all the year round at 20,000-hp a day." Captain de Lothbimere is now at Niagara studying the power transmission to Buffalo, with a view to solving the difficulty of utilizing the Seva Samundram Falls to generate electricity for the Kolar goldfields, a hundred miles distant.—*Ind. and Iron*, Oct. 6.

REFERENCES.

Electrical Congress at Como.—A long account of the proceedings of the recent Congress in session from Sept. 18 to 23. It was only a national affair, but was attended also by prominent men from other countries of Europe. The papers and addresses are noticed briefly. Some resolutions were adopted, among which were a vote to draw up safety rules on certain broad and well ascertained lines, and a vote to adopt as the practical unit of heat, the calorie at 15° C. The results of the Congress are summed up in an editorial.—Lond. *Elec.*, Oct. 6.

Como Congress.—A good account with moderately long abstracts of all the papers is given by G. K. in the *Elek. Zeit.*, Oct. 12. A similar account is begun in *L'Ind. Elec.*, Oct. 10. The papers are abstracted in the Digest under their respective headings. It seems that almost all of them had already appeared as articles before they were read at the congress.

Congress of the French Society for the Advancement of Science.—A short account of the proceedings of the recent congress at Boulogne, with a list of the papers. The paper by Blondel on electric units, of which a very long abstract is given, seems to be practically the same as those published in the *Elec. World and Eng.*, July 29 and Sept. 23.—*L'Eclairage Elec.*, Oct. 7.

Aluminium Tests.—An account of a series of tension tests on aluminium wire and of torsion tests on aluminium rods and tubes, made in the Mass. Inst. of Technology. The results are given in seven tables. The specimens tested were sent by the Pittsburg Reduction Company.—*Tech. Quart.*, Sept.

Electric Timber Seasoning.—Mareschal.—An illustrated description of the process of Nodon-Bretonneau, referred to in the Digest, Feb. 25; also of the plant at Aubervilliers, where this process is used.—*La Nature*, Oct. 7; *L'Elec.*, Oct. 7, 14.

Technical Education.—Noble.—A reprint of an address of a general nature. Much of it deals with a comparison of England and Germany, and is favorable to the latter.—Lond. *Elec. Eng.*, Oct. 6.

Specifications.—Scott.—Some notes on drawing up electrical specifications; it is based on the conditions in England and does not seem to contain anything new.—Lond. *Elec.*, Oct. 6.

New Books.

The Centenary of the Electric Current. 1799-1899. By Dr. J. A. Fleming, M. A., F. R. S. London: The Electrician Printing & Publishing Company. 62 pages, 25 illustrations. Price, 50 cents.

This interesting pamphlet is a lecture delivered by Dr. Fleming in the Connaught Hall, Dover, on Sept. 18, 1899, during the meeting of the British Association for the Advancement of Science, 1899, on the occasion of the Volta Centennial. The frontispiece is a picture of the Volta statue in Como.

Dr. Fleming reviews the progress of electricity during the hundred years following Volta's discovery of the voltaic pile. He shows that according to Garcke, the approximate amount of capital invested in Great Britain up to the year 1898 in electrical undertakings is about $430,000,000. (A recent estimate gives $3,000,000,000 as the capitalization of the electrical industries in the United States.) He shows that this large investment has been a natural consequence of the discoveries which followed Volta's work. Volta's researches are reviewed and illustrations are given of his original apparatus. The modern theory of electricity and magnetism is reviewed in the succeeding pages with great simplicity of treatment, high-frequency phenomena are discussed and the Marconi wireless telegraph considered. Maxwell's theory is shown to be in harmony with the most recent developments. The pamphlet is an interesting account of the progress of electrical knowledge during the present century, and will be appreciated by the non-mathematical reader.

Alessandro Volta. Ai Veronesi Pietro Cossali e A. M. Lorgna. By Giuseppe Biadego. Verona, 1899. 28 pages.

A reprint of eight letters written by Volta on scientific subjects to Professors Cossali and Lorgna, from Pavia, between 1781 and 1804. These letters are interesting historically and also throw light upon the ideas prevalent among physicists in Italy during the period referred to. The discovery by Ritter of the secondary cell is referred to in a very interesting manner on page 26.

Key to Engines and Engine Running. By Joshua Rose, M. E. New York: D. Van Nostrand Company. New Edition. 410 pages, 165 illustrations. Price, $2.50.

This book is a practical treatise upon the management of steam engines and boilers, for the use of those who desire to pass an examination to take charge of an engine or boiler. It contains numerous illustrations and instruction for engineers' calculations, indicator diagrams and other valuable information necessary for the engineer and fireman. There are fifteen parts or divisions, each pertaining to a certain part of engine running. Thus, the first part treats of the care, management and inspection of boilers. The second part describes the construction of engines and power transmitting mechanism. Part third relates to examining and starting a plain slide-valve engine. Other parts treat of automatic engines, high-speed engines and reversing gears. Still others are devoted to pumps, engineers' calculations, the mechanical forces, water and steam. The closing section is a well-written treatise upon the indicator and its uses. Preceding the several parts are pertinent questions relating to the subject matter thereof.

A Practical Course in Mechanical Drawing. By William Fox, M. E., and Charles W. Thomas, M. E. New York: D. Van Nostrand Company. 100 pages, 87 illustrations. Price, $1.25.

In a comparatively small space the authors have succeeded in providing a simple and practical course of progressive lessons in mechanical drawing. The use of the instruments is ingeniously shown by means of numerous photographs representing the draughtsman in the act of performing the various operations described. In this original manner a much clearer idea is conveyed to the students than by the usual method of illustration.

The various subjects taken up in order are scale-drawing, cross-sections, shading, lettering and reading of drawings. By numerous practical exercises the student is made familiar with the methods of projection, working drawings of many pieces of machinery including rivets, screws, bolts and nuts, oil cup, gear wheel, rack and pinion, bevel gear, worm gear, engine shaft, piston and rod, valve, connecting rod, etc., being taken up. The book is clearly written and profusely illustrated. It can be recommended to prospective draughtsmen and to those who wish to acquire a working knowlelge of mechanical drawing.

Small Engines and Boilers. A Manual of Concise and Specific Directions for the Construction of Small Steam Engines and Boilers of Modern Types. By Egbert P. Watson. New York: D. Van Nostrand Company. 108 pages, 33 illustrations. Price, $1.25.

This little volume is intended for amateurs, and gives a number of working drawings of steam engines and boilers up to a capacity of 5-hp, together with description, examples of calculation and directions for building. The author claims that his book will enable one with but limited experience in machine work, and having at his command only a small lathe and vise bench, to build a small generating plant of comparatively high efficiency. This will, we fancy, depend very much upon the mechanical aptitude of the amateur workman.

BOOKS RECEIVED.

La Telegraphie Sans Fils. By André Broca. Paris: Gauthier-Villars, Imprimeur-Libraire. 202 pages, 34 illustrations. Price, 3 fr., 50c.

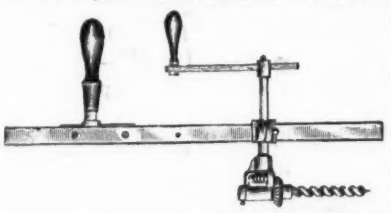
Electro-Horticulture. Electricity on the Farm and in the Garden. By George S. Hull, M. D., Sc. D. New York: The Knickerbocker Press. 45 pages.

The Elements of Alternating Currents. By W. S. Franklin and R. B. Williamson. New York: The Macmillan Company. 212 pages, 186 illustrations. Price, $1.75.

Magnetism and Electricity. An Elementary Treatise for Junior Students, Descriptive and Experimental. By J. Paley Yorke. London: Edward Arnold. 264 pages, 145 illustrations. Price, 3s. 6d.

A Universal Boring Tool.

The device illustrated herewith is designed principally for boring between joists and in close corners, but it can be used in all regular work by any mechanic. The cut shows the machine in position for boring joists or studding for placing wires or tubing parallel to the floor. Two or more sets of holes can be bored, each at a given distance from the edge of the joist. This is claimed to be the only tool with a continuous rotary movement that can be used in narrow spaces and small corners. For wiring work this tool is especially advantageous, since it enables a straight hole to be bored through the timber at a uniform distance from the edge, thus economizing in wire. This instrument which is known as the Anthony joist boring machine, is manufactured by Messrs. Hartwig & Miller, Detroit, Mich.

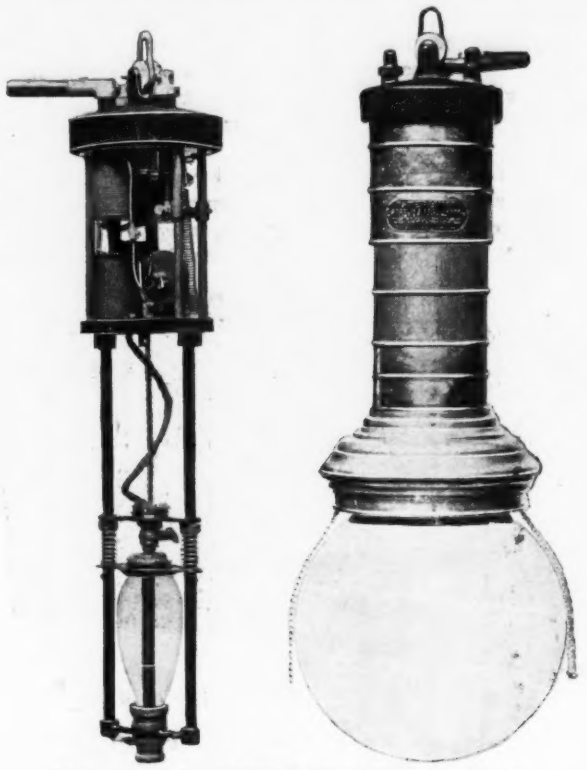


Series Alternating Enclosed Arc Lamp.

In the construction of the "Sterling" arc lamps the same feeding and controlling mechanism is used for both direct and alternating current circuits. It consists of the fewest number of parts that experience has proved to give the most satisfactory results. The

regulating mechanism is of a novel form of clutch of the chain feed type and consists, briefly, of three eccentrically movable segments engaging the rim of a drum-shaped sprocket wheel. While sensitive, the clutch is claimed to be very strong and durable, and no current passes through any part of it. Sticking or burning out of sliding contacts, overheating of the spools, etc., which constitute objectionable features in some centre feed lamps, are said to be entirely obviated in the "Sterling" lamp. A fireproof flexible cord provides direct connection with the upper carbon.

The Sterling Arc Lamp Company, 214 West Twenty-sixth Street, New York, manufactures these lamps for direct current constant potential circuits, direct current 200-250 volt circuits, alternating



FIGS. 1 AND 2.—SERIES ALTERNATING ARC LAMP.

current circuits, constant current series circuits and series alternating circuits.

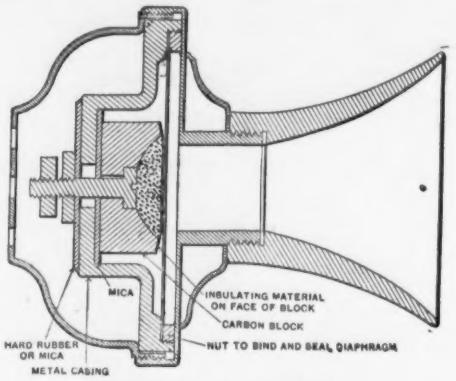
The accompanying cuts show interior and exterior views of the series alternating enclosed arc lamp. The regulating mechanism of this lamp is on the differential principle, consisting of series and shunt double coils. The laminated core is H-shaped and flexibly connected with the feeding mechanism in order to avoid vibration. The lamp is provided with an automatic cutout which is arranged to operate in the event of accident to the carbons or when they are all consumed. The upper disk of the cutout is so adjusted that it breaks the contacts before the carbons separate.

The current may be increased or the voltage at the arc decreased by lessening the tension of the spring attached to the lever; increasing the tension has the reverse effect—that is, reduces the current and increases the voltage. The carbons used for this lamp are 9½ inches long for the upper, and not less than 5½ inches nor more than 6 inches for the lower—one cored and the other solid. In retrimming, the partly consumed upper carbon may be used as the lower carbon if it is of the proper length.

Standard lamps are made for 6.6 amperes and 72 volts at the arc. The 6.6-ampere lamps are rated at 2000-cp.

Telephone Transmitter of New Design.

The telephone transmitter illustrated herewith in longitudinal section possesses some features in its construction designed to appeal both to telephone users and exchange managers. It is so constructed that the outer casing and mouthpiece may be removed for the purpose of cleansing without disturbing the diaphragm or its adjustment. This is rendered possible by fitting the diaphragm and carbon parts in an inner casing independent of the outer shell. The diaphragm is held in its place by a threaded ring which screws on to the inner casing; it is, therefore, independent of the adjustment of the mouthpiece or any other condition of the outer casing. The instrument is adjusted before it leaves the factory, and no subsequent adjustment is needed, and it



TELEPHONE TRANSMITTER.

will stand considerable rough usage without danger of derangement of the parts.

This transmitter is manufactured by the Tucker Manufacturing Company, York, Pa.

Portable Fire Alarm Combination Telephone.

The apparatus illustrated herewith is designed to provide a simple and ready means of communication for the use of fire departments, railway employees, etc. It consists of a telephone outfit, without the signaling device, and is compact and portable. Connection is effected by means of a small receptacle placed in the fire alarm box and the plug in the telephone box. This plug is shown in Fig. 1. By inserting the plug the telephone is bridged to ground through a condenser, and conversation may be carried

FIG. 1.—FIRE ALARM TELEPHONE.

on without interrupting the signal or disturbing the electrical condition of any signaling wire with which it may be connected. The outfit is not provided with signaling apparatus, since such devices are supplied in fire alarm boxes, and may be cheaply provided on other circuits. The bridge wire is normally open in the receptacle, but is closed when the telephone is connected.

The outfit is shown in Fig. 1, from which it is evident that the claims for compactness and portability are well supported. Fig. 2 gives a diagram of the connections.

On electric and other railways receptacles may be placed at suitable intervals on a wire provided with some open circuit signaling device or a ground detector at the receiving end. The outfit at the receiving end may consist of an ordinary transmitter and

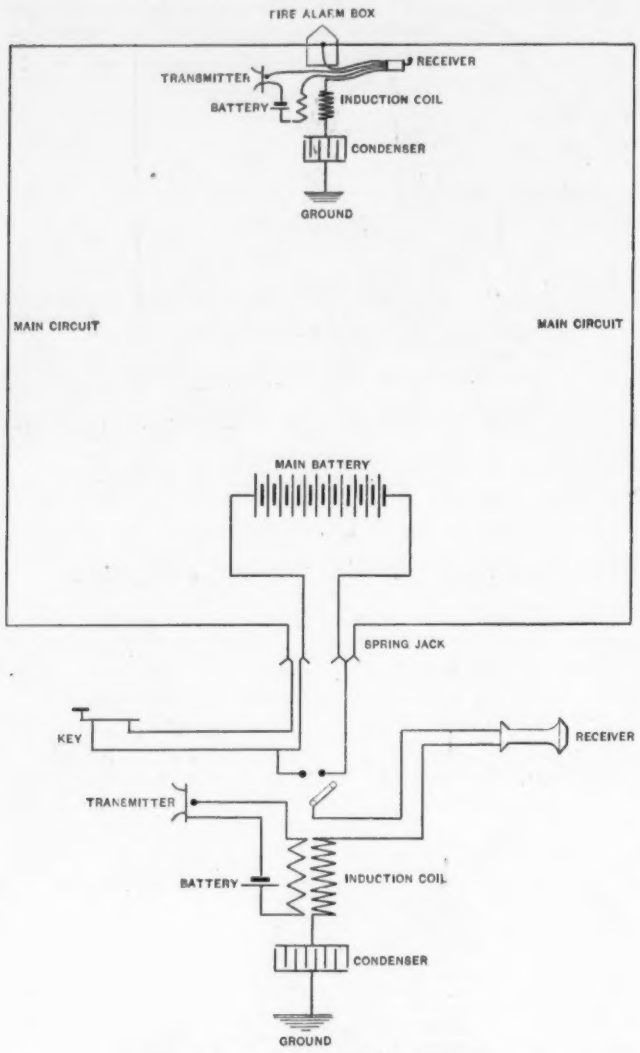


FIG. 2.—DIAGRAM OF CONNECTIONS.

receiver of any pattern, the induction coil and condenser being of the same resistance and capacity as those in the portable set.

This serviceable apparatus is manufactured by Messrs. Foote, Pierson & Company, 82 Fulton Street, New York, successors to The E. S. Greeley & Company, manufacturing department.

Dry Batteries for Gas Engines.

It is not until quite recently that the fact has made itself manifest, and become duly appreciated, that dry batteries can and should be as thoroughly adapted to the specific work required of them as are other generators of electrical energy. The wide range of work through which a good dry battery is now found useful has not only emphasized the necessity for exact adjustment to the requirements in each case, but has stimulated the progressive manufacturer to the production of types with an output, an efficiency and a durability that were not dreamed of two or three years ago. If we take the field of gas engines, for example, although these depend largely upon batteries for their steady operation, the poor satisfaction obtained was long notorious. Any old battery, wet or dry, was connected with the explosion cylinder, and its exhaustion, the disconnection of the circuit, or the wearing out of the sparking point came with fatal swiftness. To-day things are different, and much credit is due to those who upon this minor but very important part in heat or explosion engines have concentrated their thoughts and energies.

Moreover, the sudden development of the automobile field, with motors dependent upon the steady and regular ignition of some gas or explosive mixture, has again enforced the demand for a perfectly trustworthy battery and equipment, presenting conditions even more onerous while opening up a new field big with possibilities. Under these circumstances, the Non-Polarizing Dry Battery Company, of New York City, which has already over a dozen types of batteries on the market, familiar to our readers, has taken up for separate treatment the gas engine battery question, and has brought out a new form. The results both in laboratory tests, which we have witnessed, and in the rougher ordeal of practical work, apparently leave nothing to be desired. In their large factory, several groups of these batteries in series of three have been running for over 300 hours, being thrown daily for ten hours on miniature incandescent lamps, which even now after such a test, they are seen to maintain at full brightness. To hold up in voltage and amperage under severe conditions of short circuit for so long a period is an excellent sign of robustness of constitution. It is still an unfortunate fact that batteries when they go into the hands of purchasers are abused most horribly, and therefore while too much stress cannot be laid in the instructions, on the care to be taken, the success of any battery after all will depend not on the tender treatment it will get, but, on the contrary, upon its ability to stand up under the roughest usage.

The new "O. K." dry battery for gas engine work weighs about 8 to 8½ lbs. per cell. It is of rectangular construction, being 7 inches high by 4½ inches square, these dimensions, weight, etc., having all been determined by more rigid testing to be those most likely to

FIG. 1.—BOX OF DRY BATTERIES FOR GAS ENGINES.

yield greatest efficiency and longest life, with the minimum of space occupied. But this is not all. The company realizing that much may be done to help the customer take proper care of his batteries, has worked out a simple but most ingenious scheme for holding them. Going into cellars or basements and asking to see the batteries, one is usually directed to a dusty shelf in a black corner or to the bottom of a cupboard, where everything invites to early trouble and failure. The company have constructed boxes that will handily accommodate three batteries in a series, or four, five and six, should the work require as many. A space is provided for the spark or induction coil, just as in a telephone transmitter, well out of the way, and the connections are all brought out to what is virtually a little switchboard in front of the cells. Grouped into the circuits, from each cell, is a small german silver resistance, the object being to equalize the output and the work on the batteries throughout their life. The usual way with batteries when they are growing weak is to give them another as a "hill horse" to help them up, but these unequal conditions do not tend to improve matters much. In the present instance, the batteries start out with the resistance in circuit, and as they lower in output the resistances are gradually cut out, so that the batteries remain steady at the required work throughout the extreme limits of their life. Every watt that is in them is thus practically available. The lever switch and terminals on the board are all neatly and solidly made, and the batteries being numbered, manipulation is easy for any one of ordinary intelligence.

The box for the batteries is a nice piece of furniture, but not in any wise bulky or conspicuous. It is strongly made and the interior is thoroughly insulated as well as lined with resilient packing. In sending out these equipments, all that the company desires to know is the data of the conditions under which the gas engine, automobile motor, etc., may be run, i. e., number of sparks per minute required, number of hours running per day of the engine, make of the engine, whether a spark coil or an induction coil is used, whether a butting or a scraping spark is used, the material of the sparking points. Incidentally, while the scraping spark would seem naturally to take most out of a battery, the readings taken with the butting spark usually indicate the other way, suggesting to those who build and

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run gas engines the preferability of the scraping spark, so far as battery economy is concerned. An illustration is presented herewith of the company's new battery box, showing the cells connected from jacket to jacket, the method of arranging them in the box, the switchboard, etc.

Incidentally, it may be noted that the company's cheap battery, "Mustavit," a recent predecessor of the gas engine type, has been under careful test, and has run a 4-volt lamp at .2 ampere for 60½ hours.

Automobile Motors.

The accompanying illustrations show a type of automobile motor now being turned out by the Siemens & Halske Company, which has

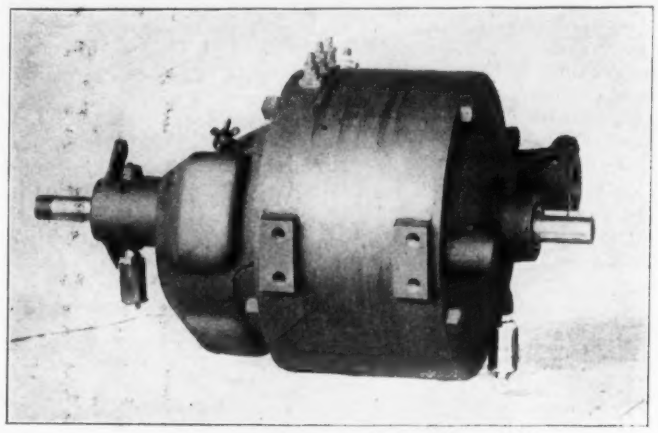


FIG. 1.—AUTOMOBILE MOTOR.

added to its works an automobile department having a capacity for 125 motors per week. The armatures are the drum type and the brushes are the same radial pattern used on the larger generators of this company. To secure maximum output with minimum weight, the fields are made of up laminated iron. The motors are four-pole,

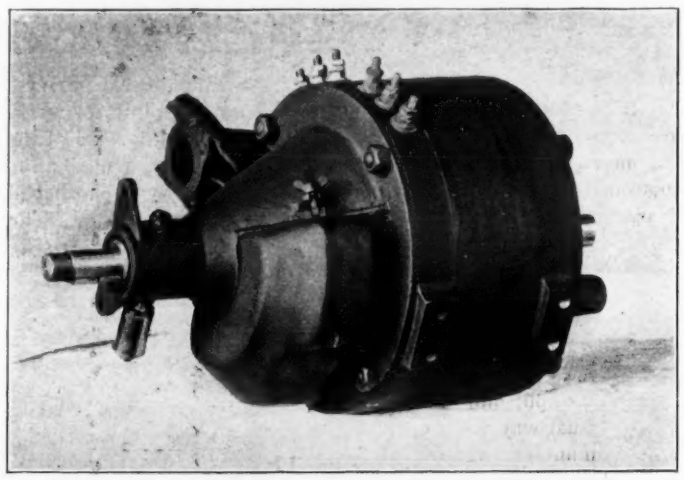


FIG. 2.—AUTOMOBILE MOTOR.

generally of 2-kw capacity, and designed to run at 800 r. p. m. as a maximum. They are tested to 300 per cent. overload, which must be carried with a rise in temperature of not more than 65° C., and they are designed to run continuously at 4-hp with a rise of not more than 40° C.

Twenty-Four Inch Projector on the Yacht Corsair.

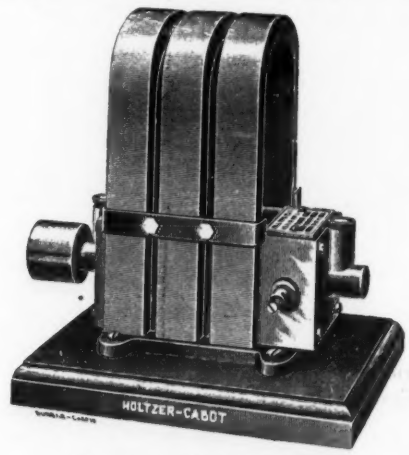
The machinery and apparatus that goes into modern steam yachts is as a general thing designed specially throughout to suit the fancy of the owner, and this applies to the searchlights at least as much as to any other part of the equipment. The Rushmore Dynamo Works, of Jersey City, make a specialty of this work and keep several draughtsmen busy the year round on special yacht projectors alone. The illustration herewith shows a new type 24-in projector designed specially by them for Commodore J. Pierpont Morgan, of the New York Yacht Club, for his new Corsair. The U frame and cylinder are carried upon a central screw stem which may be lowered so that by day the projector is entirely below the rail and the large cylinder does not obstruct the view from the bridge. When the light is required at night, a few turns of the hand wheel raises the cylinder above the rail clear of all obstructions. A number of similar "disappearing" projectors have been installed on other yachts. Among other special orders the Rushmore works have lately installed large 24-in. special projectors for Mr. P. A. B. Widener's large yacht Josephine, and Mr.

FIGS. 1 AND 2.—24-INCH PROJECTOR.

J. J. Astor's Nourmahal, in which the frame is built in the form of a large clamp around the mast. In this way the large projectors are up out of the way and are controlled from the bridge by the Rushmore mechanical controlling gear. These mast lights present a very handsome appearance and there is the added advantage that the effective range of the light is much increased when the observer can thus view the distant object without looking alongside the intense white beam of light.

Gas Engine Igniter.

The accompanying illustration represents a gas engine igniter which has been designed especially for automobile work, where a small and compact machine is desirable. The use of a dynamo for igniting the charges of gas and gasoline engines is becoming more



NEW GAS ENGINE IGNITER.

extended, and it has many acknowledged advantages over batteries for the same purpose. The dynamo shown is of the permanent magnetic field type, the armature being drum wound. The machine, which is manufactured by the Holtzer-Cabot Electric Company, Boston, Mass., has self-feeding carbon brushes and is self-lubricating. It is constructed on the same general lines as the company's standard gas

igniter, which is adapted for general purposes. The armature is enclosed and is dirt, oil and moisture proof. It can be run in either direction. The speed of this dynamo is 2000 revolutions per minute, but it can be run at any speed between 1300 and 2000.

Recent Improvements in Marine Lighting Plants.

While it is often believed that the space set apart for an isolated plant is unduly limited in modern buildings, the acme of concentration is most certainly to be found in marine work. A pertinent example of ultra compactness is afforded in the set installed upon the steamship Aberdeen, a new boat now engaged in the Pacific coast trade.

The combination illustrated in Fig. 1 consists of a Bullock type "N-I" generator direct connected to a Forbes marine engine. The engine cylinder is 5-in.x5-in. and is made for the high pressure of modern marine practice. The cylinder is supported upon three hollow steel legs which are rigidly fastened to a subbase common to both engine and generator. To two of these supports the cross-head guide is securely bolted. Means are provided to adjust for wear of the cross-head shoe and guide and in the main bearings. A system of sight feed lubricators is installed upon the side of the cylinder with copper tubes leading to all of the wearing surfaces of the engine. A small balance wheel is provided which assists in the regulation of the engine speed. The governor, which is installed on the outer end of the shaft, is of the inertia-centrifugal type and maintains a speed between no load and all load limits of less than 2 per cent. variation. The valve is of the cylindrical balance type and gives a perfcet steam distribution.

The generator, built by the Bullock Electric Manufacturing Company, of Cincinnati, is very compact, pleasing in outline and presents some excellent features of mechanical and electrical design as will be seen by consulting the sectional engraving. The yoke is a steel casting of the conventional circular form having inwardly projecting pole pieces of laminated soft steel. Each pole is bolted to the frame by two bolts "A-A," the centrally located rivet "B," of the laminated pole "C," being tapped and serving as a nut for the bolts. The armature core "D" is built up of laminated soft steel mounted directly upon the shaft and held firmly together by iron end plates "E" and nuts "F" as shown, one end plate resting against shoulder "G." Ventilating slots "H" perpendicular to the shaft provide a perfect means of ventilation. The windings "I" are machine formed and hot pressed and are perfectly insulated before being placed in the slots of the core. The windings are held in place by steel wire bands wound in slots making a flush finish with the outside of the laminated core. The armature shaft rests in a phosphor bronze bearing of liberal dimensions at the outer end and is keyseated in the hub of the engine fly wheel which is of extra width and provided for receiving the end "K." The commutator bars, shown at "L," are held together by sleeve "M," ring "N" and nut "O." Oil shield "P" prevents oil from finding its way from bearing "Q" into the armature.

The bearing "Q" is of the self-oiling type as shown. The end housing "R," securely bolted to the frame, carries the brush studs "S." The field coils "T" are machine wound and thoroughly insulated, and are slipped over the poles before the latter are bolted in position.

The engine operates at 600 r.p.m. and at this speed the capacity of the generator is 5-kw at 115 volts pressure.

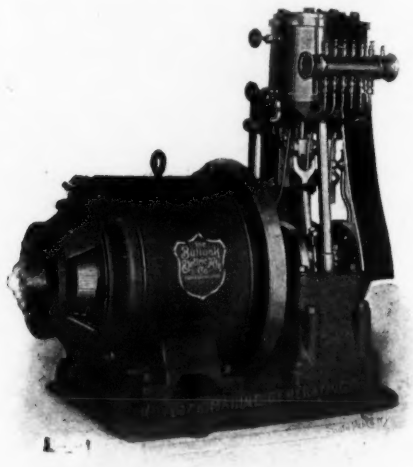


FIG. 1.—COMBINED GENERATOR AND ENGINE.

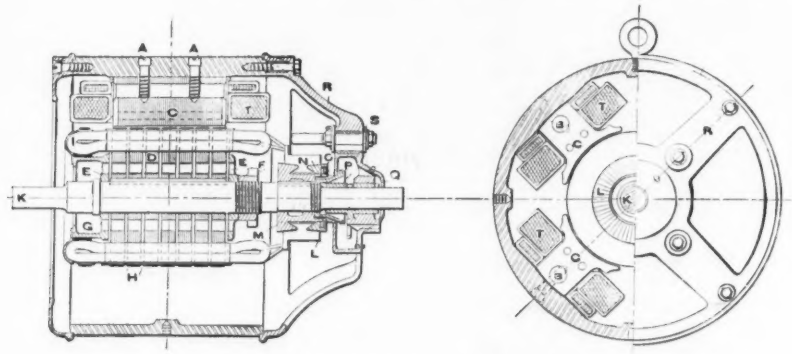


FIG. 2.—SECTIONAL VIEW BULLOCK TYPE "N-I" GENERATOR.

Desk Telephone.

The instrument illustrated in the accompanying cut is the latest of three different types of desk telephones manufactured by the Connecticut Telephone & Electric Company, Meriden, Conn., all of which are arranged for use in connection with the various systems offered by this company, both for exchange and interior work.

DESK TELEPHONE.

These instruments are fitted with a flat hook spring instead of the spiral spring generally used in this class of instruments. By the use of this spring this part of the instrument is greatly strengthened and rendered free from the bad effects of a weak spring. The standard is filled so as to give it all of the advantages of a solid metal standard, at the same time giving the instrument a much neater appearance.

The transmitter is mounted in a novel manner, and in order to remove the same, it is simply necessary to loosen two screws. The cords terminate under binding screws mounted on an insulated block in the base so that it is not necessary to unsolder the cord connections when removing or renewing a cord.

The induction coil is mounted in a metallic case on the terminal block to which the line wires and conducting cord are attached, thus making a very simple, neat and efficient device, easy to connect up.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET saw the recent general recovery carried somewhat further and the reflux of money from the agricultural districts to the banks has helped. It is still evident, however, that the great activity in trade requires all the money that can be made available and hence the money market remains very strong and firm. The bond market has been active and stocks have shown many signs of improvement. During the week General Electric on sales of 3620 shares advanced from 119¾ to 122, and Western Union on 5338 shares advanced from 87½ to 88. Metropolitan Street Railway on 13,775 shares was up 2½ to 198. Manhattan on electric equipment talk was up from 108¾ to 112½, 119,000 shares changing hands. Brooklyn Rapid Transit, though weak after so much pounding, advanced on dealings in 110,685 shares from 84⅜ to 86. In Boston, American Bell Telephone was quoted, 270-273; Erie Telephone, 118½-120; Mexican Telephone, 3½; Westinghouse Electric preferred, 66-67, common, 47¼; Boston Elevated, 107-108. In Chicago, National Carbon preferred was quoted at 80 and common at 19; North Chicago Street Railway, 236; West Chicago, 119; South Side Elevated, 99; Lake Street L, 165⅛; Union Traction preferred 81, common, 29. In Philadelphia, Electric Storage Battery common got down last week to 120. Electric Company of America was quoted at 15⅞; Penn. Mfg. Co., 25¾; Union Traction, 38¼; Phila. Traction, 96¼. National Electric, 11. In the New York outside market, Elec. Axle Light & Power was quoted at 5-5½; Elec. Boat common, 19-21; preferred, 41¾; Elec. Vehicle preferred, 100; common, 70-76; N. Y. Elec. Veh. Transportation, 15-16; New England, 7-8; Illinois, 3½-4½; Otis Elevator, preferred, 90-92; common, 29-31; Worthington Pump, preferred, 105-109. Hudson River Telephone, 114-118.

BROOKLYN RAPID TRANSIT.—It is reported that earnings of Brooklyn Rapid Transit thus far in October have increased $40,000 over the same time last year, while operating expenses are decreasing at the rate of about $3000 a day. The company has added about 250 new cars recently and about as many more are to be delivered as soon as possible. The taking over of the different parts of the system has brought to the company about $2,000,000 worth of real estate in the form of lots, shops, stations, etc. This will be sold when it can be to advantage, using the proceeds for the benefit of the property. The earnings of Kings County Elevated are not yet included in the Rapid Transit system, but will appear there in November. The third rail for electric traction has been laid in Kings County as far as Franklin Avenue, where connection is made with the Brighton Beach line and cars will soon begin to run by electric traction on this division of the road. The development of passenger traffic in Brooklyn has been extraordinary. In 1860, the total number carried by the surface roads was 11,328,009. In 1870, the number had risen to 36,431,695. In 1880 the number had more than doubled, amounting to 75,000,000. In 1890, the number had more than doubled again, being 162,837,508. It is not unlikely that the year 1900 will see another doubling of the passengers carried, as the year ended June 30, 1899, gave a passenger traffic of 289,808,895, of which 241,716,817 were carried by surface roads and 48,086,273 by the elevated roads. The increase in travel by the surface roads was continuous from 1860 up to 1888, when surface railroad travel decreased on account of the opening of the Kings County Elevated. A decrease was shown in the years 1888, 1889 and 1892. The travel on the elevated roads increased materially in those years. As soon, however, as the surface roads changed to electric traction they began to get very large increases, ranging from 13 to 28 million passengers per year while the elevated roads began to lose traffic to a serious extent. The elevated roads gained passengers in the year ended June 30 last for the first time since 1892.

BROOKLYN LIGHTING DEAL.—The final steps in the consolidation of the electric lighting properties in Brooklyn took place early this week. All of the property of the Kings County Electric Light & Power Company was transferred by lease to the Edison Electric Company, of Brooklyn, a special meeting of the stockholders of the former company having been held for the purpose. The term of the lease is thirty-eight years, and the conditions provide for the payment of all operating expenses, fixed charges and the turning over to the Kings County Company of the remaining surplus for dividends. This action places all of the electric lighting franchises in Brooklyn, except the Amsterdam Company, of Williamsburg, under the control of the Edison Company. The Edison Company also passed resolutions merging the Municipal & Citizens' Companies. There will be a saving of many thousands of dollars as a result of these mergers. The Brooklyn consolidation is controlled by Anthony N. Brady, William F. Sheehan, Hugh J. Grant and Seth L. Keeney and their friends. Mr. Brady has not appeared actively in the management because he is identified with the New York Gas & Electric Light, Heat & Power Company, which was organized for the purpose of absorbing all of the electric companies in Greater New York. It was stated on trustworthy authority that as soon as several other companies in Manhattan and the Bronx are acquired a general merger of all of them, including those in Brooklyn, will take place.

ALLEGED TELEPHONE COMBINATION.—One of the greatest financial combinations of the century is alleged by a curious despatch from Philadelphia to be in process of formation. The organizers of the Continental Telegraph, Telephone & Cable Company, recently incorporated in New Jersey, have obtained control of all the independent telephone companies in the United States and aim to combine therewith the great telegraph companies and the Atlantic cable companies. The office of the new concern is in the American Surety Company's building, New York City. From various sources it is reported that the capitalists interested in the venture include J. Pierpont Morgan, George J. Gould, John Jacob Astor, William C. Whitney, P. A. B. Widener and William L. Elkins. Verification of the story was obtained, it is asserted, from Mr. Widener, at his home in Ogontz. He talked freely of the colossal scheme, which, he says, will bring about a sweeping reduction in the cost of transmission of electrical messages all over the country. Among other things he said: "The plan has been under consideration for some time. Mr. Martin Maloney, who was the active agent in the enterprise, and who may be said to have engineered it, has been in New York for about a year. His efforts culminated when he succeeded in sufficiently interesting several big financial men in New York. Among these is John Jacob Astor. He is now one of the prominent movers in the concern."

FRANCHISE TRACTION.—Although the limit for New York City railway corporations to file their statements under the franchise tax law is reached, comparatively few of the corporations in this city have thus far complied with the law. It is said that J. Newton Fiero, counsel to the tax commission, which is to carry out the law, has discovered a technical error which he thinks may prevent its execution. The framers of the measure, on the other hand, do not regard the so-called error as fatal, although they await Mr. Fiero's views with interest. The law includes all franchises of railways "in, under, above, on, or through streets, highways, or public places." Mr. Fiero is understood to be preparing an opinion upon the omission of the word "across," which, he thinks, prevents the taxation of railways on thoroughfares which cross others. As every street railway in the city is in the category, the law in its present shape may be a dead letter. At the time of its passage, the word "across" was purposely left out of the bill, in order to avoid taxing the great steam railways of the state for their crossings, many of which were owned and paid for by the corporations before the highways themselves were laid out.

ELECTRICAL PROPERTIES IN YORK, PA.—The York Telephone Company and the York Electric Light, Heat & Power Company, of York, Pa., have been bought outright by a syndicate headed by Edward C. Jones & Company, of New York City, and Philadelphia. Mr. Jones states that the properties are absolutely distinct so far as business management went, but had simply been acquired by the same owners. Both properties are in prosperous condition. The electric concern furnishes electric light, heat and power simply for York. There is a gas company there, too, but the electric is doing the bulk of the business. The telephone company's lines are now being extended to Baltimore, Md., which is not many miles away from York, and to Lancaster, Pa., as well as to other outlying points. It is a rival to the Bell people, who also have a telephone service in York, though one that does not amount to much.

DIVIDENDS.—The American District Telegraph Company, of Philadelphia, has declared a quarterly dvidend of 1 per cent., payable Nov. 15. The Michigan Telephone Company, of Boston, has declared a quarterly dividend of 1¼ per cent., payable Nov. 13. The Wisconsin Telephone Company, of Boston, has declared a quarterly dividend of 1¾ per cent., payable Nov. 13. The Erie Telegraph & Telephone Company has declared a quarterly dividend of 1¼ per cent., payable Nov. 13.

BALTIMORE SECURITIES.—The semi-annual interest due Nov. 1 on the 4½ per cent. bonds of the United Electric & Power Company, of Baltimore, and the 2½ per cent. on the preferred stock of the company will be distributed among the holders of Alexander

Brown & Sons' certificates. The interest and dividend will be paid over to Alexander Brown & Sons, who will apportion it among the certificate holders.

NEW ORLEANS TRACTION.—For some time there has been persistent buying of both issues of New Orleans Traction, based on the excellent reports had of that company's earnings. About 1000 shares of the common stock sold on one day this week from 30 to 30½, an advance of more than a point over Saturday's final bid. The bid on the preferred stock was raised from 102 to 104, but no trades were made, as no offerings of this issue could be had.

MASSACHUSETTS ELECTRIC COMPANIES has declared a semi-annual dividend of 2 per cent. on its preferred stock, payable Dec. 1. This is the first dividend to be paid by the company and was declared out of four months' earnings, but for the semi-annual period up to Oct. 1. All surplus earnings are at present being spent on improvements to the property.

ELECTRIFIED MANHATTAN.—Mr. George Gould figures that Manhattan with its electrical equipment can earn 10 per cent. on its shares. Plans have been made for the new equipment and saving in operating expense will be 25 per cent. Mr. Russell Sage says Manhattan earnings are increasing, and at present rate show 7 per cent. on the stock. He looks for 125 for the stock this year.

BOSTON EDISON ILLUMINATING CO.—The board of gas and electric light commissioners has authorized the issuance of 4000 shares of stock by the Edison Electric Illuminating Company to be offered stockholders at $175 per share.

Commercial Intelligence.

THE WEEK IN TRADE added but one more record to the others as to activity in all lines of trade and industry. The situation is not badly summed up by a little incident in our experience last week, when, calling upon a well-known engine builder for some data as to a new plant, it took him a long time to run down the particulars in the order book. Page after page was turned over in the quest, and yet the order was quite recent. "There," he said, when the item was at last found, "we engine builders used to hunt for orders not long ago in a different way. Then we could not always find them when we hunted for them. Now we have so many, hunting them up is not less difficult, but the conditions are changed." This builder, who has not been conspicuous in talking of his company's export trade, said just incidentally, as it were, that they had already shipped some thirty or forty engines abroad within a recent period and more orders were in hand. And so it goes all along the line. One of the important developments of last week was the placing of orders for not less than 1,500,000 tons of steel rails, by leading steam railroads, an event that in turn may have an influence on street railways, some of which will wait if they can, although the continuance of activity in the world's iron and steel trade seems bound to last a long time. After this immense order had been taken in the price was raised by all railmakers as follows: For standard sections, in lots of 200 tons and over, $35 per ton; in lots from 100 to 200 tons, $37; carload lots, $38, and less than carload lots, $40. Light rails, from 25 to 50 pounds per yard, $37 per ton. All the prices quoted are free on board at Pittsburg mills. The total sales aggregate about $50,000,000. This means that about one-sixth of the total steel output for 1900 will be consumed in the manufacture of rails. This does not include the orders placed by the Russian government some time ago, together with orders which will make the aggregate tonnage in rails next year much more than has already been ordered. As to general conditions, Bradstreet's report says business of the country remains at an unprecedented volume, a fact indicated by the heavy gains noted in bank clearings over those of a year ago and by the immense increase in railway earnings over the exceptionally good returns of last October. There is a quieting down of distributive trade, more particularly at retail, growing out of the unseasonably warm weather now being experienced in most sections of the country. Reflection of this is found in less urgent orders received by jobbers and in somewhat impaired collections at many points. As regards prices, however, there is no appreciable loss of strength, the great majority of quotations remaining steady, and, among those making changes, advances are still most numerous. The bank clearings for the past week were 36.6 per cent. greater than in 1898 and 57.3 per cent. greater than in 1892. Demands for all lines of electrical supplies continue strong, with prices firm and inclined to advance where not previously moved up. It is not found, however, in any line that they have advanced to the point where export trade would be injuriously affected.

EXPORTS FOR THE EIGHT MONTHS.—Present indications warrant the belief that the exports of the calendar year 1899 will be the largest in our history. The total for the eight months ending with August showed an excess of $12,000,000 over the corresponding months of 1898, which was the largest calendar year in our exporting history, and the September statement of breadstuffs, provisions, cottons and mineral oils, just issued by the Treasury Bureau of Statistics, shows for those four classes alone an excess of $12,000,000 over September of last year. When to this is added the fact that the exports of manufactures are now much larger than at this time last year, and that even in the re-exportation of foreign goods the figures of this year exceed those of last, it seems probable that the calendar year 1899 will show a larger total of exports than that of any preceding year. The increase in exportations shown by the figures of the eight completed months is chiefly in manufactures. While the exportation of agricultural products is heavy, it is naturally and almost necessarily below that of the corresponding months of 1898, when the shortage in crops abroad gave unusually high prices as well as an unusual demand. Among the items for the eight months are iron and steel and their manufactures, $68,008,071, as compared with $52,925,082 for the eight months in 1898; copper and manufactures of, $25,197,056, as compared with $22,952,485; instruments, including electrical, $3,610,766, as compared with $1,987,653, and electrical machinery, $1,828,048, as compared with $1,439,743.

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following exports of electrical materials are from the port of New York, for the week ending Oct. 20: Antwerp—57 cases electrical material, $2350. Argentine Republic—113 packages electrical machinery, $13,200; 260 cases electrical material, $16,109. British Guiana—20 packages electrical material, $450. British West Indies—3 cases electrical material, $1067. Brazil—195 cases electrical material, $11,357; 6 cases electrical machinery, $523. British East Indies—7 cases electrical material, $218. Brussels—1 case electrical material, $20. British Australia—19 cases electrical material, $483. Baden, Switzerland.—1 case electrical material, $50. Central America—72 cases electrical material, $1400. Cuba—254 cases electrical material, $908. China—24 cases electrical machinery, $600. Chili—3 cases electrical material, $129. Copenhagen—6 cases electric motors, $126. Danish West Indies—13 cases electrical material, $1215. Ecuador—90 packages electrical material, $986; 3 cases electrical machinery, $108. Glasgow—4 cases electrical material, $320. Hong Kong—22 cases electrical material, $625. Havre—108 packages electrical material, $10,511; 121 packages, electrical machinery, $3150. Hamburg—1 case electros, $30. Liverpool—129 packages electrical material, $5573. Porto Rico—8 cases electrical material, $143. Stettin—6 cases electrical material, $1000. Uruguay—24 cases electrical material, $615.

THE RUSHMORE DYNAMO WORKS, Jersey City, N. J., have lately installed two of their 24-inch projectors each on the United States transports Thomas and Logan. With these two ships the Rushmore works have equipped all of the transports, making a total of thirty-six Rushmore projectors, no other make being used in that service. They have in the last few weeks sold a large number of similar searchlights for commercial work, including four 18-inch size for the new Onderdonk ocean dredges for improving New York harbor, two 18-inch to the Canadian government for ocean dredges, four for the new Morgan and two for the new Cromwell line steamers building at Newport News, four for the Merchants' & Miners' line, Baltimore, two to the Boston & Philadelphia line, one for the large new Metropolitan line to Boston, two for the New York & Cuba Mail Steamship Company's new steamers, two for the new sea tugs for the Staples Coal Company, two for the Reading Coal Company's sea tugs and two for the sea tugs of the Consolidation Coal Company. The Baltimore, Chesapeake & Richmond Steamship Company have put Rushmore projectors on all their ships and have just ordered another of large size for their new steamer building at Philadelphia for the York River line. The Rushmore works are also completing nearly fifty naval type projectors of various sizes for the new vessels now under construction in the United States navy.

THE CHEMICAL & ELECTRICAL COMPANY has been incorporated with a capital of two million dollars. This company has secured all of the patents, trade marks, etc., of the Electrozone Company, together with all the additional patents that have been issued to Mr. A. E. Woolf. The directors of the company are: George W. Stockly, president; Calvin H. Allen, vice-president; Leonard B. LeVake, secretary and treasurer; Albert E. Woolf, and W. Scott Sims. Mr. Stockly is well-known as the former highly successful president of the Brush Electric Company, and later as the leading spirit in the dynamite gun industry. The Woolf system of making disinfectants by electrolyzing salt water has already been described in these pages, and is familiar from its use at Brewsters, N. Y., Rikers Island, N. Y., by the City of Philadelphia and by the United States government at Havana, Cuba. A big business awaits the new company, affording a market also for a wide range of electrical material and apparatus.

BRASS AND COPPER COMBINATION.—A movement which has been under way looking to the pooling of the interests of the Waterbury Brass Company, the Coe Brass Manufacturing Company, operating mills in Torrington and Ansonia, and the Ansonia Brass & Copper Company, is assured. These three large concerns are to be consolidated under one general management, each corporation, however, remaining in many respects under the control of its own board of directors, as at present. Nearly all of the stockholders of these companies have consented to this plan. The details of the plan have not yet been made public, but Charles F. Brooker, of Ansonia, the head of the Coe Brass Manufacturing Company, will be the manager of the combined companies. It is thought that the central office will be located in Waterbury. It is understood that the promoters of the combination are endeavoring to secure the charter of the American Brass Company, in order to secure the advantages of organization under it.

REFRIGERATING PLANTS.—The Ohio & Pittsburg Milk Company will equip their depot with a refrigerating plant, at Pittsburg, Pa., order for which has been placed with the York Manufacturing Company, York, Pa. The contract calls for a complete refrigerating plant of six tons capacity. The plant is also to make in addition one ton of ice per day. The East Orange (N. J.) Ice Manufacturing & Distributing Company is a new organization recently formed in that city. The company will erect an ice making plant to be in operation in time for next season's business. The contract has also been placed with the York Manufacturing Company for one of their latest improved brine circulating plate systems. The plant will be of thirty tons capacity and will contain all the latest improvements. The York Company are also turning out large numbers of their McCormick, Jr., turbines.

HAVANA ELECTRIC RAILWAYS.—A good deal of data has already been given in this department as to the equipment of the new trolley lines of the Havana Electric Railway Company, of which Mr. G. F. Greenwood, formerly of Pittsburg, is purchasing agent, general manager, etc. Mr. Elmer P. Morris is furnishing most of the miscellaneous supplies, and a large order for Kerite feeder cables, etc., has gone to W. R. Brixey. The Ansonia Brass Company will fill an order for $60,000 of copper trolley wire, and the Electric Railway Equipment Company will furnish 2200 iron poles to the Morris Electric Company. The order for generators and motors has been placed with the General Electric Company, and includes three 850-kw direct-connected generators and 110 car outfits, each with two motors of 25-hp each.

ITALIAN ELECTRIC RAILWAY CONCESSIONS.—A despatch from London states that the Italian government, through its railroad department, has granted concessions to the Thomson-Houston Electric Company for the construction of about 50 miles of electric road in various parts of Italy. One of the projected lines is intended to run between Naples and Castellemare, a seaport town situated at the base of Vesuvius. Another electric road will be built between Rome and the fashionable suburb of Frascati, which is some 12 miles distant from the capital. A third trolley road will be operated between Genoa and the thriving town of Gallarate. This road will be 23 miles in length. It is understood that a great deal of the necessary apparatus will be bought from the General Electric Company in this country.

THE SCOTT-JANNEY ELECTRIC COMPANY.—The officers of the Scott-Janney Electric Company, which was incorporated in New Jersey a short time ago with a capital stock of $30,000,000, have been elected as follows: President, William S. Janney, Philadelphia; vice-presidents, Charles W. Darke, New York, and Edward A. Abbott, Concord, N. H.; chief engineer, Gordon J. Scott, Philadelphia; secretary, Charles F. Walter, Philadelphia; treasurer, Jacob A. Janney, Philadelphia. The office of the company is in Philadelphia. It is stated that the stock of the company which was offered to public subscription a short time ago, has been subscribed and the company is prepared to go ahead with its plans for the introduction of Mr. Scott's new apparatus for electric railway and other power work.

STROWGER AUTOMATIC TELEPHONE SYSTEM has not only become well-known in this country but has made its way abroad. The Direct Telephone Exchange Corporation has been organized in England with an authorized capital of $1,500,000, half 6 per cent. preference shares and half common, 130,000 preference shares to be issued and the vendors taking the common stock in part payment. Exchanges have already been installed for the Glasgow corporation in the municipal buildings, for the Jersey Automatic Telephone Company, Town Hall, St. Helier's; D. H. Evans & Company, Ltd., London, and the Prudential Assurance Company, Ltd., London. It is also stated that the corporation of Tunbridge Wells, England, has entered into a contract for a system.

ELECTRICITY IN MEXICO.—Confirming news already received, the bureau of American Republics reports that Mr. Thomas Braniff, Jr., of the City of Mexico, has petitioned the department of promotion for permission to establish an aluminum factory. The capital which will be employed in the undertaking will be about $1,000,000. Electrical energy derived from water power in the State of Vera Cruz will be utilized. The finances of the City of Mexico are on a solid basis, the receipts amounting to more than $400,000 per month, while the expenditures are only $360,000. The city lighting service comprises 481 electric street lights of 2000-cp, 366 of 1200-cp, and about 150 incandescent lights of 50 and 16-cp. The cost of the service is about $24,000 per month.

DECLINE IN COPPER.—Lake copper was quoted last week at 17½ cents. In the metal trade it is said that the market for copper here still manifests an unsettled feeling, notwithstanding higher cables from London. Domestic buyers continue to show hesitations, and no activity is apparent. Electrolytic is quoted 17¼ @17½c. with the market dull. It has been expected in the trade that the difference in the price of lake and electrolytic would disappear in consequence of the greater demand for the latter. It is said there is no diminution in consumption here and exports are increasing. Aluminum keeps cutting in, as in the case of the Northwestern Elevated, of Chicago, where 150,000 pounds are being used in the feeder cables.

STANDARD PNEUMATIC TOOL COMPANY, Marquette Building, Chicago, inform us that their mechanical superintendent, Mr. Henry James Kimman, has sailed for England in order to superintend the installation of machinery in the works of the International Pneumatic Tool Company, at Chiffenham, Wilts, England, the latter corporation having recently purchased the rights to manufacture and sell the "Little Giant" pneumatic tools and appliances in the British Empire. That done, Mr. Kimman will make a tour of inspection and instruction of the Standard Pneumatic Tool agencies in Paris, Brussels, Berlin, Dusseldorf, Vienna and Amsterdam. He will be absent about three months.

LISBON ELECTRIC TRAMWAYS.—W. B. Rommel, general manager and chief engineer of the newly formed Lisbon Electric Tramways Company, sailed for home a few days ago after placing contracts aggregating $1,000,000 for material and equipment. The above mentioned company will operate the first trolley road in Portugal. The scheme has been taken up by the great London financial house of Wernher, Beit & Company, which is also interested in Mexican and South American horse roads now about to be converted into trolley lines. All the equipments will be purchased in the United States.

THE MORRIN CLIMAX BOILERS at the Omaha Expositions for 1898 and 1899 have all been sold. The Council Bluffs Street Railway Company has taken one 500-hp and one 250-hp; the Madison Street Railway & Electric Light Company, one of 250-hp; and the International Packing Company, of Omaha, have purchased for their new plant at Sioux City, Iowa, three of 500-hp and one of 200-hp.

COPPER WIRE FOR POSTAL.—The Postal Telegraph Company has within the past few days placed orders for copper wire aggregating 1,000,000 pounds. These are extra orders over and above the usual requirements of the company. It is understood that the price was about 19 cents a pound. The wire is to be delivered before the end of the year.

AMERICAN BICYCLE COMPANY AUTOMOBILES.—In its statement to the bicycle trade last week the American Bicycle Company announced that one of the largest factories taken in by the trust would hereafter be devoted solely to the manufacture of automobiles, and that the business would be extended as rapidly as possible.

MR. M. M. KOHN, general manager of the Oceanic Gas & Electric Company, Ltd., of Honolulu, Hawaiian Islands, is visiting New York on business and staying at the Hoffman House. He is making arrangements for business, etc., in the electrical and mechanical lines, and will be glad to see or hear from anyone interested in the development of trade in that quarter.

ENGINE BUILDERS BUSY.—The Allfree Manufacturing Company, of Indianapolis, is very busy filling orders for engines to furnish power for electric light plants. Orders are being filed for engines to be sent to Porto Rico, and Rome, Italy. Notwithstanding the slight increase in prices the orders continue to multiply.

THE NEW BRITAIN MACHINE COMPANY, of New Britain, Conn., has just received an order for 22 of its high-speed Case engines, which are to be used in Kent, England, and which have been specially designed to be operated with compressed air instead of steam.

CHILI.—The Westinghouse Electric & Manufacturing Company has recently installed an electric light plant at the nitrate works at Tarapaca.

Special Correspondence.

NEW YORK NOTES.

New York, Oct. 31, 1899.

MR. W. J. WATSON has become the representative in this city of the American Electrical Works, of Providence, and will maintain the old relations with friends and customers.

AUTOMOBILES IN CENTRAL PARK.—Mr. W. E. Buzby, owner of a Riker electric automobile, has caused himself to be arrested for entering Central Park with his vehicle, in order to test the legality of the present absurd regulations excluding such carriages. Magistrate Olmsted, of the Yorkville police court, refused to entertain the complaint against Mr. Buzby, on the ground that it was not shown that an automobile was not a pleasure carriage.

T. J. MURPHY & CO.—Thomas J. Murphy and Joseph F. McGuire, who composed the firm of T. J. Murphy & Co., formerly manufacturers of electrical supplies at 511 and 513 West Thirteenth Street, have filed a petition in bankruptcy. The total liabilities are given at $6593, less $1521 paid to creditors, leaving a balance of $5072 liabilities. They made an assignment on Dec. 11, 1896, and the assets realized $1521 for the creditors, who received a dividend of 15 per cent.

HUDSON TELEPHONE COMPANY'S PLANS.—The directors of the Hudson Telephone Company, of Jersey City, met recently and decided to extend its system through the old Hudson City and Bergen districts and to begin the construction of the necessary conduits at once. After the meeting it was stated that the company's line from New York to the foot of Morgan Street was completed, and that connection would be made as soon as the proposed independent company should secure a foothold in New York.

ACME ELECTRIC LAMP COMPANY.—The sheriff has received an attachment against the Acme Electric Lamp Company, of 1659 Broadway, for $774, in favor of Fred B. Ames, and a keeper was put in charge. The attachment was obtained on the ground that the company is a New Jersey corporation. The attachment is based on two notes of the company which were indorsed for accommodation by Guy Phillips, the vice-president, who had to pay them. The business was started in June, 1896, and the present company was incorporated in December, 1898, with a capital stock of $500,000.

GAS FAMINE AT PEEKSKILL, N. Y.—For some reason or other the gas supply at Peekskill has lately run very short. Fortunately, the streets are lighted by electricity. B. B. Nostrand, owner and manager of the electric light works, is reaping a harvest, and his linemen are busy from early morning until late at night wiring stores and houses. The Peekskill Gaslight Company is putting up a $50,000 plant in Water Street, which will be one of the largest and best along the Hudson River, but it will not be ready until Dec. 1, although it is being pushed as fast as skill and men can push it.

MR. P. C. ACKERMAN, who for the last thirteen years has been identified with the American Electrical Works as its representative in New York City, has been appointed general sales agent for the Rhode Island Electrical Works, of Pawtucket, whose officers are Eastwood Eastwood, president; C. D. Wood, treasurer, and A. F. Montgomery, general manager. The company is now making magnet wires in sizes from No. 14 to No. 40, and Mr. Ackerman is already securing some very nice business. He has opened headquarters at the Havemeyer Building, 26 Cortlandt Street, where he will be glad to receive orders and inquiries and all his old friends.

A STREET CLEANING WAGON has been invented by Miss F. W. Parpart and Mr. H. B. Layman. It sweeps and loads at the same time, and can be operated by animal power, electricity or compressed air. Good reports are made of it. Among those who are interested in the proposed revolution in street cleaning methods are Henry L. Shippy, manager and treasurer of the John A. Roebling Sons' Company; State Senator Richard H. Mitchell, Edward C. White, the president of the White Manufacturing Company; Walter L. Pierce, the secretary and manager of the Lidgerwood Manufacturing Company; Daniel T. Kissam, the vice-president of the New York Commercial Association; Neville G. Latimer, manager of the New York Commercial Association, and A. J. Bings, commission merchant.

BROOKLYN TRANSFERS.—President Rossiter, of the Brooklyn Rapid Transit Company, has announced a number of changes contemplated on the company's surface and elevated lines. They will go into effect this week. It is planned to establish a system of transfers between the elevated and surface roads at various points. The object is to divert suburban traffic from the trolley lines to the elevated roads, and relieve the congestion of travel on lower Fulton Street and other downtown thoroughfares. A large number of trolley cars are to be taken off, as under the new arrangement nearly all the suburban surface lines are to turn their passengers over to the elevated roads at outlying points. These changes will chiefly affect the Coney Island, Bath Beach, Jamaica and Ridgewood sections. These changes, it is expected, will result in a great saving of time to suburban travelers and leave the cars in the downtown sections of the borough more free for riders who go comparatively short distances.

LIGHT FOR STATEN ISLAND.—An agreement was reached at a conference last week between Comptroller Coler and the representatives of the New York & Staten Island Electric Company, by which the company will accept in full payment for lighting the Borough of Richmond from and including 1897 to June 30, 1899, the sum of $150,686.21. Lighting will now be resumed. The stipulation which was signed by both parties especially provides that the city does not by this payment recognize the binding force of the contract or contracts which the electric company entered into with the Staten Island municiaplities before it became a part of New York. Comptroller Coler said that there was not a single light company which had furnished the city with light that had received any payment for their services since Jan. 1, 1898, because the municipal assembly had held up the contracts. The only reason why he could pay the Staten Island Company was because they had at least some kind of a contract, while the other companies had none.

NEW ENGLAND NOTES.

Boston, Mass., Oct. 28, 1899.

THE MASSACHUSETTS TELEPHONE & TELEGRAPH COMPANY worked a very clever trick on the Bell representative, the New England Telephone & Telegraph Company, in Stoughton, the past week. A small independent company had been operating in Stoughton for some time and had about eighty subscribers, using non-Bell telephones. The New England Company stepped in and bought out the small company, but, as it could not use the instruments under the patent regulations, it did not purchase them. The Massachusetts Telephone Company entered the fight, secured a franchise, bought the instruments and secured a majority of the subscribers. Wires were put up and an exchange will be started the coming week. The actual extent of the New England Company's purchase is, therefore, somewhat in doubt. In addition to this, the company has let the contracts for laying wires in Summer Street and Dorchester Avenue, in this city. They have already been laid through several of the downtown streets, and it is expected that a small exchange will be in operation before Christmas.

PENNSYLVANIA AND OHIO NOTES.

Philadelphia, Pa., Oct. 28, 1899.

WILLIAMSPORT RAILWAY.—The Montoursville Railroad, a trolley line between this city and Montoursville, has changed hands. The purchasers are the Railway Company General, of Philadelphia. E. A. Tennis, of Philadelphia, has been the president of the road.

THE SAWYER ELECTRICAL COMPANY, of this city, has purchased the electrical business formerly conducted by Mr. W. H. Houston, at Ogontz, and will continue the business at the same location. A force of experienced workmen under a skilled superintendent will be located at Ogontz, and repairs or construction work will be promptly and thoroughly done.

JERSEY INDEPENDENT TELEPHONY.—Directors of the Hudson Telephone Company propose to unite; all the independent telephone lines in New Jersey will be discussed. The Hudson Telephone Company is operated in opposition to the New Jersey & New York Telephone Company. The former has formed an alliance with the Newark Telephone Company. The Hudson Telephone Company has authorized the increase of its capital stock $300,000 making the total of $1,000,000.

THE YORK TELEPHONE COMPANY and the York Electric Light, Heat & Power Company, of York, Pa., have been bought outright by a syndicate headed by Edward C. Jones & Co., of York and Philadelphia. Both properties are in prosperous condition. The electric concern furnishes electric light, heat and power simply for York. The telephone company's lines are now being extended to Baltimore, Md., which is not many miles away from York, and to Lancaster, Pa., as well as to other outlying points. It is a rival to the Bell people, who also have a telephone service in York.

THE WILLIAM CRAMP & SONS SHIP & ENGINE BUILDING COMPANY, of Philadelphia, will make extensive additions to their already large plant, and have placed the order for the new buildings with the Berlin Iron Bridge Company, of East Berlin, Conn. The new machine shop will be 142 feet wide and about 350 feet long. Three stories in height. All the floors, including the gallery floors, are to be controlled by electric traveling cranes. The building will be of steel framework, the outside walls of brick, and will be one of the largest and most complete machine shops in the world.

Pittsburg, Pa., Oct. 28, 1899.

MR. DUNCAN SINCLAIR, general manager of the Coalbrookdale Iron Manufacturing Company, of Shropshire, England, who is making a tour of the industrial establishments of this city, was a visitor at the Westinghouse works a few days ago.

THE LOCAL LIGHT COMPANIES have petitioned the city council for an exoneration of the payment of certain city taxes, which they say they ought not to pay according to a decision rendered some time ago by the Supreme Court of the state of Pennsylvania.

THE RITTER-CONLEY MANUFACTURING COMPANY, of Pittsburg, Pa., has been awarded a contract for the construction of four street car sheds for the United Railway & Electric Company, of Baltimore, to cost about $300,000. The contract includes the erection of steel buildings to be used as a car barn, paint shop, repair department and machine shop, and will consume altogether about 3000 tons of structural steel.

TELEPHONES IN RUSSIA.—Fred De Land, the president of the Federal Telephone Company, with headquarters in this city, has made an investigation into the telephone system of Russia and according to some comparative figures given out by Mr. De Land it appears that there are more telephones in Allegheny County—that is to say, Pittsburg and vicinity—than in the whole vast Russian empire, although the population of Russia is 97,000,000, while that of Allegheny County is only 4,500,000.

Cincinnati, Ohio, Oct. 28, 1899.

MR. T. J. RYAN, of the Siemens-Halske Company, secured the contract for the municipal plant at Bainbridge, Ohio, and was in that town this week making necessary arrangements.

THE LAWTON-BEATTIE COMPANY has finished wiring the new quarters of the Business Men's Club and, considering the fact that a goodly percentage of the membership is made up of electric men, of course, did an exceptionally neat job.

MR. GEORGE DEVOU, of the Post-Glover Company; J. B. Pevear, of the General Electric Company, and M. Brown, of the Standard Electric Company, local members of the Supply Dealers of the central states, left on Wednesday

for Chicago to attend the meeting of that division which was in session yesterday and to-day.

MESSRS. JANTZ AND LEIST have just put in a 500-light machine with a double switchboard to furnish the illumination in Val Duttenhofer & Sons' new shoe-manufacturing concern—an addition to the present plant. The Lawton-Beattie Company did the wiring for the system. The Edison Company took out the old machines, which were in use prior to the building and occupancy of their present fine quarters at Canal and Twelfth streets. It is understood that they received nearly as much for them as the machines cost when new, owing to the recent heavy advance in material.

THE CONSOLIDATED STREET CAR COMPANY has promised to change the Mount Auburn cable into an all electric line, but Secretary Collins finds that the company will be delayed in so doing until a shipment of rails has time to arrive from Antwerp and Rotterdam. In investigating the cost of the proposed improvement Mr. Collins found that steel rails from those places could be delivered in Cincinnati 30 per cent. cheaper than the domestic product, and will accordingly place his orders abroad. Moreover, Secretary Collins says he believes the German make are of better material than the American and is now in correspondence with the agents of the foreign firms with reference to placing his orders.

Cleveland, Ohio, Oct. 28.

THE BUCKEYE ENGINE COMPANY, of Salem, Ohio, is figuring on removing its entire plant to La Porte, Ind.

W. D. EASTLAKE, of Tokyo, Japan, who is interested in a syndicate which is planning to buy up all the street railways in that country and equip them with electricity, was in Cleveland last week buying machinery.

THE AMERICAN DISTRICT TELEGRAPH COMPANY, Cleveland, has been reorganized with the following officers: President, H. D. Bennett; vice-president, C. Corbett; treasurer, T. W. Hill; secretary, G. R. Johnson.

THE COLUMBUS, BUCKEYE LAKE & NEWARK TRACTION COMPANY, is endeavoring to secure a right of way through Columbus in order to enter into direct competition with the Columbus Railway Company now operating all the electric lines running into the business section of that city.

F. M. HAYNES, superintendent of the Lorain & Elyria Electric Railway, has resigned his position to go to England to superintendent several electric lines which Tom L. Johnson, the ex-congressman, is building. F. M. Zimmerman, of Atlanta, Ga., has been appointed to the place thus made vacant.

THE CLEVELAND ELECTRIC RAILWAY COMPANY, Cleveland, is equipping several of its lines with double truck cars. An order for 100 of these cars was placed some time ago and they are now being received at the rate of several a week. They are 40 feet long, and are provided with 75-hp motors. The bodies are the product of the J. G. Brill Company, Philadelphia, while the electric equipment is from the Westinghouse Electric & Manufacturing Company, Pittsburg.

THE CLEVELAND TWIST DRILL COMPANY, Cleveland, is preparing to move into a four-story, 230 x 40 feet addition to their plant. An independent power house is also nearly completed, and as soon as possible the entire plant will be equipped with the electrical plan of power transmission, each department being operated by motors independent of the balance of the plant. The engine is from the Harrisburg Foundry & Machine Company, the boilers from Babcock & Wilcox Company and the electrical equipment from the General Electric Company. The capacity of the Cleveland Twist Drill Company will be doubled by the new arrangements.

INJUNCTION SUIT.—Proceedings have been started in the circuit court of Lucas County, this state, against the Toledo, Norwalk & Fremont Electric Railway Company, to prevent the further laying of tracks and with a view of asking an ouster for the road. Attorney General Monnett, who instituted the proceedings, holds that the county commissioners had no right to grant a franchise over the old Western Reserve road on the ground that it is a government highway leading to Cleveland, which, being a public highway, cannot be given to a private corporation. The state authorities want an injunction and $20,000 damages for the portion of the road already built. Notwithstanding the ouster proceedings, the railway company is hard at work with a large force laying tracks and building power houses. The county commissioners will assist the railway in fighting the case, which is believed to be of great importance, since there are a number of such roads in process of construction, or projected in this state.

WESTERN NOTES.

Chicago, Ill., Oct. 28, 1899.

MR. J. E. HASCHKE, 98 Ogden Avenue, who was working on a light storage battery for automobiles, had his laboratory visited by thieves, who got away with the apparatus he had already worked out.

MR. GEORGE P. REX, secretary of the Columbia Incandescent Lamp Company, St. Louis, Mo., and prominent throughout the electrical fraternity, has been receiving a hearty welcome in Chicago during his recent call.

THE CHICAGO UNION TRACTION COMPANY will increase its number of directors from seven to 11. A special meeting of stockholders has been called for Nov. 20, to make the necessary change in the bylaws of the company. It is expected that the stock of this company will be listed in New York during the next three or four weeks.

AS TO AUTOMOBILE LICENSES.—Numerous complaints have been made because the ordinance for licensing automobile operators passed by the city council last summer has not been put into effect. City Electrician Ellicott, who was commissioned to enforce the measure, explains that the reason he has not done so is because the mayor is not as favorably inclined to the idea of regulation as he was at the time the ordinance was passed. It is understood that the mayor has an amendment he would like to have considered by the council.

BRANCH ELEVATED ROADS.—A rumor is current in Chicago railroad circles that the Union Elevated loop officials have held conferences with representatives of the various railroad companies centering in the city concerning a plan to unite the loop with all the large passenger depots by means of a system of spurs. The method of operation has not been divulged. The persistency of the report gives color to the presumption that in the near future the elevated loop will have reached out so as to cover the downtown district with a network of raised steel structures.

CHICAGO'S STREET RAILWAYS.—The city council judiciary committee has decided to recommend the adoption of a resolution authorizing the mayor to appoint a commission of seven aldermen to gather information on which to base ordinances for renewal of the street railway franchises. The commission is to be given power to gather information and make recommendations regarding the questions of terminals, transfers, motive power, rates of fare, municipal ownership, compensation to be paid the city, tunnels, accommodation of passengers, and other terms and conditions on which franchises should be extended.

A WIRE COMPANY'S STEAMSHIPS.—By its purchase of the big steel steamer W. H. Gilbert and two Wolvin boats the American Steel & Wire Company has come into possession of a Lake fleet of 12 vessels, which will be in commission on May 1 next. The fleet will have a capacity of 75,000 tons of iron ore at a single trip, or over 2,000,000 tons for the season. Negotiations are now pending for two other large steamers, which, if carried out, will increase the season's carrying capacity of the American Steel and Wire fleet to 2,500,000 tons. This will be about equal to the capacity of the company's mills, and will make it independent of the individual vessel owners and the big carrying fleets.

WILL BUILD HAWAIIAN ROAD.—Chicago capitalists are interested in a new railway that will be built on the island of Hawaii within the next year. Herbert B. Gehr, of 234 La Salle Street, is one of the incorporators of the new company, which has been organized under the laws of the Hawaiian Islands, with a capital of $3,000,000. The road will be known as the Kohala & Hilo railway and will connect the port of Hilo with Mahkona and Kohala. The total trackage of the road, including branches, will be 130 miles and will open to cultivation a large, fertile territory heretofore inaccessible. The road will be operated by electricity, generated by water power. It is expected that the road will start with 100 20-ton cars and six electric locomotives.

Indianapolis, Ind., Oct. 26, 1899.

ELECTRIC RAILWAY PROJECTED.—It is proposed to build an electric railway from Lafayette, via Shawnee Mound, to Covington, penetrating the coal fields at Newton. Ample capital is said to be behind the scheme.

RAILWAY FRANCHISE GRANTED.—The council of Hartford City has granted a franchise to F. G. Brownell, of Muncie, which completes the franchise and right of way of his interurban line between Muncie, Eaton, Dunkirk and Hartford City. The railway is to be operated by electricity, compressed air, or any other modern power except steam. It is given out that capitalists of Philadelphia and Indianapolis will build the road at once.

ADDITIONAL TELEPHONE WIRES.—Two additional telephone lines are ready for use between Green Castle and Indianapolis, thus giving three wires between the two cities. One of the new lines is a direct wire between the points named and connects with no other towns along the way. The other additional wire connects Danville, a prosperous county seat at the half-way point. These lines were strung by the New Telephone Company, of Indianapolis, and are copper metallic throughout.

A FRANCHISE GRANTED.—The commissioners of Marion County, on Oct. 18, granted a 50-year franchise for an electric railroad to a company composed of Adolph Sorge, Jr., O. A. Stranahan and F. F. Vater, of Chicago, and Charles W. Taylor, of Grand Rapids, Mich. The right of way extends from the city limits of Indianapolis, along the Michigan or Shelbyville road to the Shelbyville County line. The county is to receive each year $25 a mile for each mile of track owned by the company in the county.

TELEPHONE CONSTRUCTION.—The Marion Telephone Company is working hurriedly on its long distance line from Marion to Bluffton, where it will make connections with all the principal cities and towns of northern Indiana and northeastern Ohio. Mr. Overshiner, the local manager, says the line is practically completed and connection will be made in a few days. The company is also working on a line running west from Marion to Kokomo, at which place it will receive connection with the Independent long distance line from Indianapolis.

TELEPHONE CONSOLIDATION RUMORS.—A rumor was current recently that the consolidation of the New Telephone Company and the Bell Telephone Company was about to be effected. Secretary Gates, of the New Company, however, denies that such consolidation is contemplated and says: "We have started out with this company to stand or fall, and we are not going to consolidate. Consolidation rumors are started by the Bell Company and I am sure that company would like to consolidate, but the New Company will not. There is no truth whatever in the report."

FRANCHISE OPPOSED.—The business men of Shelbyville are much disturbed over a talked-of electric railway between Shelbyville and Indianapolis. They have effected an organization to fight the granting of a franchise by the county commissioners and the city council on the ground that such a line would ruin the business interests and lessen the value of real property. On the other hand, a large number of citizens, who are not in business and desire cheap transportation to Indianapolis, are in favor of the line, claiming that 100 business men have no right to fence in the city for their own benefit, while over 5000 people would be benefited by the line. The projectors of the road are on the ground and are preparing to ask for a franchise and right of way and the excitement is running high.

WHY RATES WERE INCREASED.—Mr. O. Rex, of North Manchester, Wabash County, is the owner of a system of long distance telephone connecting a dozen or more towns of that and adjoining counties. The rate for a five-minute conversation has been 10 cents. Recently the Bell long distance telephone line opened up in a portion of this territory, and to the surprise of patrons Mr. Rex gave notice of an advance to 15 cents in the conversation rate over lines in which the Bell Company competed. Mr. Rex says he was forced

to advance the rate by the Bell Company, the latter serving notice on him that the rate would be 15 cents, or it would be nothing; and rather than bring on a rate war he was compelled to duplicate the Bell Company's rate. To non-competing points the Rex rates are unchanged. Patrons are indignant and claim that they would have stood by Mr. Rex.

MUNICIPAL OWNERSHIP OF TELEPHONE.—The city council of Logansport has by resolution recommended the purchase by the city of the Mutual Telephone plant. This company's property is owned by E. B. Overshiner, who began business in Logansport four years ago in opposition to the Central Union. Rates were cut in two and telephones furnished business houses for $1.50 a month; residences $1 per month. Both companies have maintained the same rates, but without profit. Each company had about 300 subscribers. Municipal ownership of telephones has been agitated in Logansport for some time, and the success with which the city manages the electric light and waterworks plants has aroused a favorable sentiment to invest also in the telephone. Mr. Overshiner has an interest in the Winamac, Ellwood and Marion plants, and is desirous of selling his Logansport plant.

DAMAGES BY EXPLOSION OF METAL.—An action has been brought by Anna G. Graham against the Indianapolis Street Railway Company and the North American Improved Rail Joint Company for $10,000. The complaint alleges that on July 1 complainant was passing along Pennsylvania Street, at point where at the time the rail joint company was engaged in connecting the joints of the street car company's rails with molten metal, heated in a street smelting machine, and that at the time she was passing the employees of the company emptied the hot metal into a bed of wet sand, causing an explosion which threw metal in every direction, some of which fell on the plaintiff, burning her severely, and permanently injuring her nervous system. It is understood that this is a test case, that a dozen more injured parties will also bring suit unless settled with, in case Miss Graham obtains a judgment.

St. Louis, Mo., Oct. 28, 1899.

ELECTRIC RAILWAY PROJECT.—The New Florence, Belle Flower & Middletown Electric Railway was organized Oct. 26 at Belle Flower, Mo. The capital stock will be $80,000. The road will be 22 miles long and will traverse the best section of Montgomery County.

STREET RAILWAY PAPERS FILED.—The papers in the bond issue of the United Railways Company and the lease of the United Railways Company to the St. Louis Transit Company were placed on record last week. The St. Louis Trust Company is trustee in the mortgage for the bondholders. The deed covers all the property and franchises of the company, securing the issue of $45,000,000 of bonds. The bonds run for 35 years and will bear 4 per cent interest. The deed required $12,000 worth of revenue stamps. The lease covers all of the property of the United Railways Company, and is for 40 years.

LINDELL RAILWAY COMPANY WON.—A petition for an injunction restraining the Lindell Railway Company from extending its lines along Hamilton Avenue was filed in the Circuit Court last week, and was denied by the presiding judge. The court held that the petitioners had not shown that remedy of injunction should apply to their case, although they learned they would be greatly damaged if the lines were built as proposed. The petitioners will appeal to the Supreme Court, where they hope to get a reverse. Meanwhile the railroad company has put its men at work on the Hamilton Avenue grade and the case will probably be decided before the line is built and in operation.

San Francisco, Cal., Oct. 22, 1899.

DR. PHILIP MILLS JONES was recently reappointed instructor in electrotherapeutics for the medical college connected with the University of California, San Francisco. Upon President Wheeler's advice the college medical staff was reorganized.

THE OROVILLE WATER & POWER COMPANY was recently incorporated, with Oroville, Cal., as the principal place of business. Capital stock, $300,000, with $250,000 actually subscribed. Directors, C. P. Lott, E. W. Fogg, J. C. Osgood, R. S. Powers and P. R. Parsons, of Oroville.

MR. WYNN MEREDITH, electrical engineer for the Truckee River General Electric Company, recently left Virginia City, Nev., with a small engineering party. They will locate the route for the pole-line from the new plant. After reaching the foot of the Geigor grade the pole-line will be carried over the grade into Virginia City and along D Street. It is proposed to locate the distributing station near the Chollar mill.

SOUTHERN NOTES.

Mexico City, Oct. 20, 1899.

TELEGRAPH AND TELEPHONE WIRES IN MICHOACAN.—The official report of the governor of the state of Michoacan, Mexico, shows 815 kilometers of telephone and 281 kilometers of telegraph wires in operation in that state.

WATER POWER INVESTIGATION.—Engineer Ramon Ibarrola, of the City of Mexico, has been appointed by President Diaz to make an investigation of the water power afforded by the River Atoyac, in the state of Puebla, and to formulate regulations to govern the application of its water power to industrial enterprises.

ELECTRIC LIGHT AND POWER PLANTS are being installed in a number of the principal mines in the Parral district, in the state of Chihuahua, Mexico. This thriving mining camp now has direct railway communication with the outside world, the Mexican Central's branch line from Jiminez having been completed to that place.

ELECTRICITY ON MEXICAN SUGAR PLANTATIONS.—Many of the larger sugar plantations in the state of Vera Cruz, Mexico, are being equipped with electric plants for operating sugar mill machinery and some heavy shipments of electrical machinery to be used for this purpose have recently arrived at the port of Vera Cruz, Mexico, from New York City.

MEXICAN STREET RAILWAY SOLD.—The street railway system owned and operated by the Industrial Railway Company, and which connects the city of Puebla, Mexico, with Cholula, Huejotzingo, Panzacola and Covadonga, has been sold to the Federal District Street Railway Company, of the City of Mexico. The purchase price is not known to the public. This company now owns the street railway systems of the city of Puebla, the city of Guadalajara and the City of Mexico, in addition to its latest acquisition, as above noted.

ELECTRIC RAILWAYS IN CITY OF MEXICO SUBURBS.—A company of Mexican capitalists has been organized in the City of Mexico to construct an extensive system of street railway. The company has obtained a concession from the Mexican government for the proposed lines and it is said that the work will soon begin. The system will connect all of the principal suburbs of the city with each other and if the plans of the company are carried out the new lines will be strong competitors with the present suburban lines of the Federal District Street Railway Company.

Richmond, Va., Oct. 28, 1899.

DISPLACING STEAM WITH ELECTRIC POWER.—The Richmond Locomotive & Machine Works, the largest plant of the kind in the south, employing 1200 men, are throwing out their steam power and adopting electric power at a cost approximating $25,000. The machines as far as possible are direct connected to motors. It is estimated that a saving of 25 per cent. will be made through doing away with the shafting and belting.

RAILWAY FRANCHISES.—The competition for the expiring railway franchises of the Richmond Railway & Electric Company is steadily growing stronger. The two competitors are known as the Newton-Boyd Syndicate, made up of Richmond business men, and the Richmond Traction Company. The Newton-Boyd Syndicate petitioned the city council to renew the franchises, saying they had an option on them at present, and would purchase and put the lines in first class condition if the privileges asked for were granted. The Traction Company has met their offer and asked that the franchises be put up at auction, saying that they would not only put the lines in good condition, but would give the city $50,000 besides for them. It is considered a generous offer, as this sum is exclusive of the cost of buying the lines from the present owners, and only for the right of way. The offer is now before the city council and promises to provoke a lengthy discussion.

General News.

THE TELEGRAPH AND TELEPHONE.

MADISON, IND.—It is proposed to build a telephone line along the Ohio River from Madison to New Albany.

IDA GROVE, IOWA.—The Ida Grove Telephone Company is a new corporation just organized at Ida Grove, with a capital of $2,500. Its directors are J. W. Reed, J. S. Weiser, B. S. Noble, R. S. Wasser, Frank Hess, J. E. Conn, Fred Brasted, L. K. Page, L. Q. Spaulding.

BRADDOCK, PA.—The Allegheny Telephone Company, of Braddock, and the McKeesport local telephone company will be connected Nov. 1, furnishing a local telephone connection between those two towns and Homestead.

BENZONIA, MICH.—A new independent telephone company has been organized here. The exchange will connect with Cadillac, Manistee, Traverse City, Benzonia, Frankfort, Honor, Thompsonville, and other intermediate villages. The central exchange will be here. Sufficient shares have been taken to insure the success of the enterprise, and work will be begun immediately.

PITTSBURG, PA.—The Federal Telephone Company has been extending its purchases along the line of the West Penn Railroad. Fred De Land, president of the company, states that the telephone plant at Avonmore, the telephone toll line from Avonmore to Saltsburg, the toll lines to Edri and Salina, and the half interest in the toll line to Apollo have just been bought. The company will immediately proceed to build a trunk line the entire length of the valley from Freeport, where the new exchange is being completed, and another will be erected at Leechburg. The Federal Telephone Company filed articles of incorporation at Trenton, N. J., a few days ago, with a capital stock of $10,000,000, all of one class. The capital comes from Chicago.

ELECTRIC LIGHT AND POWER.

MARSHALL, N. C.—The North Carolina Electrical Plant Company is building a modern plant at Marshall, with one of the highest dams of masonry in the south. Mr. W. B. Ellis is president and Mr. W. A. Lemly treasurer.

OCEAN CITY, N. J.—By the recent collapse of a huge water tank adjoining the electric light station the latter was ruined by the water and debris, and the citizens were compelled to return to the use of oil lamps and cistern water.

FISHKILL, N. Y.—The village of New Paltz is in darkness. The electric light plant changed hands recently, and because the new owner thought it did not pay him he closed down. The trustees have given him 60 days to resume or stand a suit for breach of contract.

THE ELECTRIC RAILWAY.

WEBB CITY, MO.—The Southwest Missouri Electric Railway Company, of Webb City, filed a statement of increase of capital stock from $650,000 to $800,000.

JEFFERSON, OHIO.—The commissioners of Trumbull County, Ohio, will grant a 50-year franchise to the Burton-Jefferson-Warren Electric Railway Company for the proposed Ashtabula-Warren electric line.

HELENA, MONT.—The Helena Power & Light Company, which controls

the street railways, has opened its new suburban line to East Helena, a distance of six miles. It carries passengers, expressage and freight.

CAPE COD, MASS.—The Boston & Cape Cod Railway Company has been formed to build an electric road from Freetown to Buzzards' Bay. The line will make connection with several important points in Massachusetts.

POOR'S MANUAL OF RAILROADS, just issued by H. V. and H. W. Poor, Edison Building, New York, is as useful and as complete as ever, covering the whole field of railway operation, and furnishing data and statistics of the most valuable character.

BOMBAY, INDIA.—Consul W. T. Fee states that steps are being taken to convert the street railway into an electric line. It is a double track, with 17½ miles in operation, and the franchises cover the entire city. The road is partly owned in this country.

MAMARONECK, N. Y.—After a hot fight which has lasted nearly three years, the village trustees have voted to grant a franchise for a trolley road on the Boston Post Road to the Tarrytown, White Plains & Mamaroneck Railway, which is now a branch of the Union Railway Company, of New York.

DENVER, COLO.—Otto Mars, the projector of the Washington & Chesapeake Railway, is preparing plans for an electric line between Ouray and Red Mountain. A wagon road connects the two points. At some places it rises 1000 feet up the mountain side. The current for the new line is to be generated by water power.

LAWRENCE, KAN.—Master-in-Chancery H. P. Dillon has sold a small railway running out of Lawrence to W. E. Winner, for the Kansas City, Lawrence & Topeka Railway Company, for $51,000. The property will be made part of the electric road which is now being built between the cities named and which is backed by Indiana capitalists.

DELAWARE.—The New Castle & Delaware City Railway Company, which will soon begin the work of building its line, has organized by electing the following officers: President, Harry A. Richardson, of Dover; Vice-President, F. H. Treat, of Philadelphia; Treasurer, Peter J. Ford, of Wilmington; Secretary, Peter L. Cooper, Jr., of Wilmington.

PLAINFIELD, N. J.—Chandler W. Riker, head of the trolley syndicate that is about to gridiron Union County, says he will give $800 to have the road leading through the "Notch" from North Plainfield to Washingtonville widened, providing a trolley franchise be granted to his company. Mr. Riker says that the road could be running by July 1.

ALBANY, N. Y.—A certificate of incorporation of the Middletown-Goshen Electric Railway Company, which is a reorganization of the Middletown-Goshen Traction Company, has been filed. The capital stock is $100,000, and the directors are William B. Brooman and J. Howard Koop, of Chester, Pa., and William F. Riddle, L. A. Dehring and Frank D. Graham, of Philadelphia.

JEFFERSON, OHIO.—The board of county commissioners have granted an additional 99 years' franchise to the Burton-Jefferson Electric Railway Company, from Jefferson east through Denmark and Pierpont to the Pennsylvania line. This, added to those previously given, completes the franchise over Ashtabula County entire of the lines proposed to connect Cleveland, Warren and Erie.

"TROLLEY TRIPS" is the title of a very neat, useful and interesting pocket brochure brought out by Miss Katharine M. Abbott, of Lowell, Mass., showing how one can tour through historic New England, parts of the Long Island shore, etc., for a few nickels. As a Liebig's extract of travel, history, literature and useful information, we know nothing to equal this and other similar pamphlets by Miss Abbott.

THE CLEVELAND & CHAGRIN FALLS ELECTRIC RAILWAY COMPANY has secured the right of way for a new branch line from Chagrin Falls to Garrettsville. General Manager Palmer states, however, that because of the inability to secure material at this time, it will be impossible to build the line this year. Work is being pushed on the extension from Chagrin Falls to Middlefield, and it will probably be in operation within sixty days.

TROLLEY EXTENSIONS IN OHIO.—An electric line project is under headway that will give Ohio resort cities a continuous service from Tiffin to Toledo by way of Sandusky. It is the object of an eastern syndicate to tap Lakeside, Put-in-Bay and Catawba business not only for passengers, but for fall fruit trade. It is also proposed to secure the Lakeside & Marblehead Road and change it from steam to electricity. Right of way is being secured.

COLUMBUS, OHIO.—The Columbus, Buckeye Lake & Newark Traction Company will enter into direct competition with the Columbus Railway Company, and if present plans go through, they will land their passengers right in the heart of the city. The company has already secured a franchise on the National road east to the county line, and the next step will be the introduction of an ordinance in the city council granting the right of way of East Mound Street.

WAYNESBORO, PA.—The Blue Ridge Electric Railway Company, composed largely of Baltimore capitalists, organized with a view of building a trolley line from Waynesboro to several mountain resorts around Pen-Mar, has asked the Waynesboro town council for a franchise to lay tracks in Waynesboro. The road is to be finished in 18 months and work is to begin in six months. The company stipulates that it will not transfer the franchise, and offers to give an indemnity bond for $10,000.

BEDFORD CENTRE, N. Y.—The Bedford & Eastern Railway has filed articles of incorporation with the secretary of state. It is to build and operate a street surface electric road three miles long, from Bedford Centre to Bedford Station, Westchester County. The capital stock is $30,000. The directors are Charles Haines and William H. Lyon, of Bedford Station; William V. Malloy and John J. Crennan, of New Rochelle; George Jenngst, Jr., Horace B. Thacher, and Charles J. F. Deeker, of Croton Falls; Henry B. Barrett, of Katonah, and Isaac Purdy, of Purdy's Station.

ALBANY, N. Y.—The agreement to consolidate was filed by the directors of the New York & North Shore Railway Company and the Long Island Electric Railway Company. The first named has a capital stock of $1,500,000, and the second $600,000. The corporate name of the consolidated companies will be the New York & North Shore Railway Company, and its capital $2,100,000. The directors are William H. Shelmerdine, of Whitestone, N. Y.; Charles A. Porter, of Philadelphia; William F. Hogan, of Brooklyn; Jacob R. Beetem, Rudolph McCabe and William E. Stewart, of New York City.

NEW COMPANIES.

EQUITABLE HEAT, LIGHT & POWER COMPANY, Davenport, Iowa. Capital, $200,000. Incorporators, A. J. Robertson, G. B. Nye, E. L. Parrish.

SYRACUSE AUTOMOBILE COMPANY, of Syracuse. Capital, $10,000. Directors, William D. Andrews, Henry T. Trebert and C. Arthur Benjamin, Syracuse.

JEFFERSONVILLE LIGHT & POWER COMPANY, Jeffersonville, Ind. Capital, $5000. Incorporators, J. C. Knight, H. C. Knight, L. Ivens, all of Jeffersonville.

SUNRISE TELEPHONE COMPANY, Tazewell, Tenn. Capital, $10,000. Incorporators, J. A. Soard, J. C. Carr, G. Lively, J. H. Wuillen, H. Y. Hughes, all of Tazewell.

THE JOHNSON COUNTY TELEPHONE COMPANY, Iowa City, Iowa. Capital stock, $25,000. Incorporators are A. T. Presson, H. L. Nortn and D. Mahan.

EATON TELEPHONE COMPANY, Eaton, Ohio. Capital, $50,000. Incorporators, W. W. Morrison, F. J. Bollmeyer, C. F. Brooke, Jr., J. Alexander, C. B. Cokefois.

CONSOLIDATED ELECTRIC SUPPLY COMPANY, of Brooklyn, N. Y. Capital, $10,000. Directors, F. S. Braillard, Jr., Grace B. Braillard and Chas. T. Boyd, Brooklyn.

TWIN CITY ELECTRICAL RAILWAY COMPANY, Aberdeen, Wash. Capital, $75,000. Incorporators, L. C. Dillman, E. B. Bern, S. Bern, E. France, all of Aberdeen.

INDEPENDENT LONG DISTANCE TELEPHONE COMPANY, Clinton, Iowa. Capital, $10,000. Incorporators, R. J. Miller, F. M. McElroy, E. L. Miller, all of Clinton.

THE SWEDISH-AMERICAN TELEPHONE COMPANY, Chicago; to manufacture telephones. Capital, $50,000. Incorporators, F. Bain, T. Lidberg, M. F. Allen, all of Chicago.

THE MOORE VENTILATOR COMPANY, of New York, has been chartered in Delaware to manufacture steam, electric, compressed air and cable cars. The capital stock is $100,000.

HERCULES ELECTRIC DRILL COMPANY, Denver, Colo. Capital, $5,000,000. Incorporators, S. Lesem, C. Wiseheart, L. Lesem, E. P. Long, W. R. Burchinell, all of Denver.

UNITED LIGHT & POWER COMPANY, of Camden, N. J.; to manufacture gas, electricity, etc. Capital, $100,000. Incorporators, V. H. Conkle, Thos. F. Deegan, William F. Eidell.

BALDWIN AUTOMOBILE COMPANY, Augusta, Me.; to manufacture automobiles. Capital, $200,000. Incorporators, H. Fraser, of Providence, R. I.; C. L. Andrews, D. Bowman, both of Augusta.

DANSVILLE GAS & ELECTRIC COMPANY, of Dansville, N. Y. Capital, $80,000. Directors, S. N. Blake, Elmira; James N. Edwards, George B. Sweet, B. H. Overdorf and James A. Jackson, Dansville.

GIBSON COUNTY TELEPHONE COMPANY, Humboldt, Tenn. Capital, $20,000. Incorporators, E. L. Mendenhall, E. B. Mendenhall, W. Mendenhall, V. T. Grizzard, J. T. McKibben, all of Humboldt.

THE INDEPENDENT LONG DISTANCE TELEPHONE COMPANY, of Clinton, Iowa, has been incorporated, with a capital stock of $10,000. Its directors are Roy J. Miller, E. L. Miller and Frank M. McElroy.

STERLING ELECTRIC COMPANY, Lafayette, Ind.; to manufacture electrical appliances. Capital, $100,000. Incorporators, F. B. Cook, W. E. Doolittle, C. M. Murdock, H. A. Taylor, M. Levering, all of Lafayette.

THE KNOXVILLE ELECTRIC COMPANY has been formed, with a capital of $100,000, to erect an electric and ice plant in Knoxville, Pa. J. P. Moore is president, and C. D. Lockwood, secretary, of the new company.

FINDLAY HOME TELEPHONE COMPANY, Findlay, Ohio; to build and operate telephone lines. Capital, $30,000. Incorporators, J. C. Firman, W. J. Burket, M. M. Carrothers, Kora F. Briggs, W. S. Wagner, E. C. Taylor, J. B. Hoge.

NEW JERSEY & PHILADELPHIA STREET RAILWAY COMPANY. Capital, $90,000. Incorporators, W. M. Butler, of Boston; J. F. Shaw, of Newburyport, Mass.; J. J. Lovett, of Emilie; W. G. Howell, of Morrisville; C. Walton, of Philadelphia.

INTERSTATE TELEPHONE CONSTRUCTION COMPANY, New York City; to construct and operate system of electrical conductors. Capital, $1,000,000. Incorporators, F. E. Wallace, Clarence M. Smith, of New York City; James Virdin, of Dover, Del.

WEST LIBERTY STREET RAILWAY COMPANY, West Liberty, Pa.; construction and maintenance of street railway. Capital, $12,000. Incorporators, H. Moore, J. C. Fisher, J. S. McKelvey, all of Pittsburg; A. C. Wettengel, of Elliott; G. Hook, Jr., of Bellevue.

THE CANNON VALLEY TELEPHONE COMPANY, Waterville, Minn.; to conduct and operate telephone lines. Capital, $15,000. Incorporators, C. B. Talman, J. A. Carr, of Minneapolis; J. J. Worlein, C. H. Bliss, A. J. Kanne, of Waterville; C. C. Whitman, of St. Paul.

THE WEBER ELECTRICAL MANUFACTURING COMPANY, of New York City, has been incorporated to manufacture and deal in electrical appliances. Capital, $1,000,000. Incorporators, J. Pott, V. L. Sawyer, J. Weber, E. P. Schmidt, W. H. Klogh, all of New York City.

THE SAFETY APPLIANCE & EQUIPMENT COMPANY, an automobile manufacturing company of Portland, Me. The capital is $100,000. R. A. Jor-

dan, of Boston, is president, and F. E. Rowell, of Kittery, treasurer and clerk. C. R. Fuller and J. R. Kimball, of Boston, are other incorporators.

LAKE GEORGE LIGHT, HEAT & POWER COMPANY, of Warren County, N. Y.; to furnish electricity to Caldwell, Warrensburg and Bolton. Capital, $50,000. Directors, Royal C. Peabody, of New York City; Louis W. Emerson, of Warrensburg; Frank E. Loughran and A. R. Noble, both of Caldwell, N. Y.

AUBURN LIGHT, HEAT & POWER COMPANY, of Auburn, N. Y.; to furnish gas and electricity. Capital, $50,000. Directors, Liddon Flick, John Flannigan, Addison A. Sterling, Edwin H. Jones, Eugene W. Mulligan, and Reuben J. Flick, Wilkesbarre, Pa., and John M. Brainard, Edwin S. Newton and Franklin P. Taber, Auburn.

THE CHEMICAL & ELECTRICAL COMPANY, of New York City; for the purpose of making and dealing in chemicals, cosmetics and electrical energy of all forms. Capital subscribed, $2,000,000, with the privilege of increasing the same to $5,000,000. The shares are held by Albert E. Woolf, Calvin H. Allen, George W. Stockly, W. Scott Sims and Leonard B. Levake, all of New York City.

THE NIAGARA FRONTIER ELECTRICAL & MACHINE COMPANY has been incorporated to do business at Niagara Falls. It has a capital of $15,000 and will start business with $7500. Directors, R. D. McIntyre, E. E. Tuthill, G. J. Jackson, J. H. Reid, J. T. Lister and A. G. Lister. The company will occupy a building on Main Street, near the Hydraulic Power & Manufacturing Company's district.

SUBMARINE BOATS.—The Subsurface Torpedo Boat Company, with an authorized capital of $1,000,000, was incorporated last week at Trenton, N. J., to construct submarine and torpedo boats. The incorporators, whose post office address for the purpose of incorporation are given as Paterson, are Clarence L. Burger, William Barbour, William McAdoo, Henry P. Taylor, Charles D. Halsey and William Williams.

THE AMERICAN FINANCE & AUDIT COMPANY has been incorporated in New Jersey. Capital, $500,000. The company is authorized to purchase and hold bonds, mortgages, etc., of corporations; to audit and examine the financial standing of persons and corporations, and to make reports thereon to interested parties, and to act as financiers for capitalists. The corporators are G. W. Eisenberg, W. C. Porter and K. S. Oiler, of Camden.

THE AUTOMOBILE.

THE ST. LOUIS MOTOR CARRIAGE COMPANY, of St. Louis, has filed a statement of increase of capital stock from $30,000 to $50,000.

NEW YORK CITY.—The first run of the Automobile Club of America takes place Nov. 4, being 20 miles out and home, starting from the Waldorf-Astoria at 2 p. m. Refreshments will be served at the Claremont on Riverside Drive. Some 75 automobiles are expected to be in line.

MORE AUTOMOBILES FOR ST. LOUIS.—The Gould Messenger & Carriage Company, of St. Louis, has closed a contract with a Brooklyn (N. Y.) corporation for three automobiles, to cost $1666 each. They are to be delivered by Dec. 1 and if successful the company will operate them exclusively.

THE MASSACHUSETTS AUTOTRUCK COMPANY, of Worcester, Mass., is soon to be incorporated in New Jersey. It will have a business connection with the International Power Company, and Joseph Leiter is considering a proposition to utilize for the new company the American Wheelock Engine Company's plant in Worcester.

MOTOR CAR COMPANY IN RICHMOND, VA.—Lawyers for the Old Dominion Motor Car Company are preparing the charter and at the next meeting of the council a franchise to run automobiles in the streets will be asked. The capital stock of the company will not be less than $100,000. Capt. Andrew Pizzini, of Richmond, will be president, and the others interested are V. G. Robinson, of Philadelphia; J. F. Barry, J. P. Evans and Albert Davis, of New York City, N. Y.

AUTOMOBILES IN WASHINGTON.—The commissioners of the district have decided that a steam engineer's license is necessary for operating on the streets of Washington automobiles run by steam generated from gasoline, benzine or other motors. The purchaser of an automobile, known as a locomobile, operated by steam, recently inquired of the commissioners whether a permit would be required before the machine could be placed on the streets. Operators of electric automobiles are not required to take out licenses. The gentleman in question is a Mr. G. Edmonston.

LEGAL.

CORPORATION TAXES.—The Iowa Supreme Court yesterday handed down a decision against the present system of assessing and taxing insurance, express, telegraph, telephone, sleeping-car and fast-freight companies. The law provides that they shall pay certain percentages of gross receipts to the state treasury. The court holds that corporations must be assessed on the same basis and for the same purposes as individuals.

MUST PAY FARE.—The Milwaukee Electric Railway & Light Company have scored a victory in the trouble which they recently had with the citizens of Racine, Wis. August Hyman, who had been sent there with others from Milwaukee to eject people who refused to drop their fares in the box, was arrested on the charge of assault and battery for ejecting Louis Wischman from the car. The best legal talent in the city was employed to prosecute the case and others to defend the prisoner. A great deal of testimony was taken, and evidence showed that Wischman knew of the order in regard to dropping in fares before he boarded the car, but did so for the purpose of finding out whether the men would eject him. He offered his fare to the motorman and Hyman, but they refused it and ejected him. Judge D. H. Flett, of the municipal court, held that there was not sufficient evidence to hold the prisoner on the charge of assault and dismissed him. The next cases to come up are the charges of conspiracy against about 20 Racine citizens. The company has dismissed seven of the original 30 cases.

PAINLESS DEATH IN ACCIDENTS.—A special despatch from New Haven, Conn., of Oct. 26, says: A suit for $5000 damages in each case brought against the Bridgeport Traction Company as operating corporation by an administrator on the estates of E. E. Bradley and wife, who were killed in the Peck's Bridge trolley disaster last summer, may determine an important law point in this state. Just before the Peck's Bridge disaster, in which 28 lives were lost, Judge Wheeler had rendered a decision in the Superior Court holding that under the state law practically only nominal damages could be obtained in a case where death was sudden and painless. This decision, it is understood, influenced strongly a number of settlements after the trolley disaster. The suits just brought will, if not settled, determine not only the responsibility for the accident, but also the Connecticut law of damages as to sudden and painless death. Judge Wheeler's ruling is questioned by lawyers in this state, and the judge himself, in making the ruling, severely criticised the law. The complaint in the Bradley suits alleges gross and wanton negligence, imperfect roadbed, car, curves and guard rails and overworking of the motorman in charge of the car.

STREET RIGHTS OF TELEPHONE COMPANIES.—Two important telephone cases have been decided by the Detroit Supreme Court, and some of the remarks of the court are of general public interest as defining the general powers and duties of municipalities in dealing with telephone companies. The telephone company interested is generally known as the Bell Company, and is the successor of the Telephone & Telegraph Construction Company, which in 1881 received permission to erect poles and wires and operate its lines in the city of St. Joseph. In 1897 the telephone company put up new poles and wires in the city. The common council declared them a nuisance, and under its orders the street commissioner removed them from the street. In deciding the case in favor of the telephone company, the Supreme Court says that the erection of poles and wires is essential to enable the company to do business; that there is ample space in the streets, and that no public necessity justifies the refusal. "Under the act authorizing its incorporation," says the court, "complainant has power to construct and maintain lines of wire with necessary fixtures along, over, across, or under any public places, streets and highways in the state. Its duties are to receive and transmit messages without discrimination and to furnish service without unreasonable delay. The sole authority of the municipality is the proper exercise of the police power, inherent in it, to protect the public from unnecessary obstructions, inconveniences and dangers, and to determine where and in what manner complainant may erect its poles and stretch its wires. It has no authority to impose other conditions. That authority rests in the legislature—the charter-making power."

MANDATORY INJUNCTION AGAINST ELECTRIC LIGHT COMPANY REFUSED.—Justice Beekman, in the New York Supreme Court, Special Term, has overruled the demurrer of Benjamin A. Gould to the answer of the Edison Electric Illuminating Company in his suit for a mandatory injunction requiring the company to reconnect the electric light appliances in his apartments with the company's conductors, and to resume supplying him with electric light. The controversy arose upon the reasonableness of the provision which the company required Mr. Gould to assent to as a condition of supplying him with the light desired, that he would use the light for a year, and would pay each month one cent an hour for each 16-cp lamp, the minimum monthly charge to be not less than $1.50. Mr. Gould desired 11 lamps, and the court holds that in view of the alleged total additional investment made necessary on the part of the company of at least $220 to comply with the demand, the fixed charge, not based upon actual consumption, was not of itself improper or unreasonable. "The customer," Justice Beekman said, "does not bind himself to use any particular amount of light, so that the return to the company, based on actual consumption, would rest entirely upon his volition, and it would, therefore, depend upon him whether the service he has required the corporation to be in constant and immediate readiness to render is profitable or unprofitable to the latter. But this constant condition of readiness is a necessary and unavoidable obligation, which must be sustained in order to meet instantaneously the demand for light which the consumer is entitled to have at any moment that he wishes it. It thus forms a part of the service to be rendered, and is an item properly to be considered when the reasonableness of the charges exacted by the company is called in question. To meet the contingency that one consumer, with the same number of lamps, would use more than another, the monthly minimum charge was fixed by the company. But it must be borne in mind that this payment is not in addition to the charge for actual consumption. Where light is consumed which entitles the company to payment on meter measurement, or a sum per month equal to or in excess of the so-called minimum charge, the customer pays only for the light he has actually had; so that this fixed charge becomes practically operative only when his consumption falls below the extent of use which it measures. I can see nothing unreasonable in this, when the service, as I have defined it, which the company is obliged to render, is considered. It is not a penalty for a failure to use defendant's product, but is properly to be regarded as compensatory for that part of the service which is at all times being rendered in the maintenance of the appurtenances and connections through which the electric current is made available to the customer for the production of light at his pleasure."

PERSONAL.

MR. H. E. TIEMANN, Stevens '97, has been appointed an instructor in mechanical engineering at the University of Pennsylvania.

PROF. J. B. JOHNSON was recently inducted as dean of the College of Mechanics and Engineering at the University of Wisconsin, Madison.

MR. GEORGE MOFFAT, of Philadelphia, left last week for England, on

the Etruria, to take active part in the construction of the London United Tramways and other electric roads there.

MR. Y. KASUYA, a recent electrical engineering graduate of Tokyo University, has arrived in the United States, where he will spend several years in acquiring a practical knowledge of his profession.

MR. C. H. GREENWOOD (Worcester '97), who has been connected with the Atlas Tack Company, of Taunton, Mass., has been appointed an instructor in mechanical engineering at the University of Pennsylvania.

MR. H. N. HUMPHREY, E. E., of Brunner, Mond & Co., Northwick, Cheshire, England, a large chemical concern, is now in this country investigating the subject of large gas engines and American power houses and central stations.

MR. F. M. PEDERSEN, who has for a long time been on the engineering staff of the Crocker-Wheeler Electric Company, has been appointed instructor in physics at the College of the City of New York. Mr. Pedersen is a graduate of Columbia University.

MR. J. C. HENRY, the well known electrical engineer and inventor in the railway field, returned this week to his permanent home in Denver, from New York City, where he has been spending the summer for the development and exploitation of some of his latest work.

MESSRS. GLIDDEN, Sabin, Bethell and Webb, who are studying European telephony in the interests of the various Bell telephone companies they represent, have been the subjects of a very lively article in the *Daily News*, of Stockholm, Sweden, where they have been visiting.

MR. AND MRS. E. R. KNOWLES celebrated on Oct. 6, at their residence in Brooklyn, their silver wedding, when they received the congratulations and remembrances of a host of friends. Mr. Knowles' career as an electrical engineer extends back over nearly the whole period of 25 years, and some of his earliest work was done in the early days of the development and perfection of the incandescent lamp.

Trade and Industrial Notes.

THE NEW BRITAIN MACHINE COMPANY, of New Britain, Conn., is now manufacturing all of its Case engines up to 25-hp, with a view to sectionalizing, so that they can be transported on muleback in mountainous parts of any country.

WEST SENECA, N. Y.—The Berlin Iron Bridge Company, of East Berlin, Conn., has the contract for a bridge at West Seneca, N. Y. The bridge is 20 feet wide and 117 feet long. It is of the through riveted type of trusses, and has steel floor system.

M. I. VOUGHT, La Crosse, Wis., has taken over the telephone interests of the George C. Bell Manufacturing Company, and is adding to the line of apparatus. He will soon put upon the market some radically different and improved telephonic appliances covered by patents all over the world.

SECOND-HAND ALTERNATOR WANTED.—The Union City Electric Light & Power Company, Union City, Ind., is in the market for a good, compound wound, secondhand, 1000-light alternator, complete with exciter and self-oiling bearings, and a complete station outfit for 1000 volts, all of good standard make.

"HABIRSHAW."—The India Rubber & Gutta Percha Insulating Company has issued a very neat blotter, covered with celluloid, on which is printed a most useful table of areas, weights, lengths, resistances at 75 degrees Fah. for B. & S. wires from No. 0000 to No. 30. It is very neatly and tastefully prepared.

MR. WM. ROCHE, 42 Vesey Street, New York City, has just received from the United States Torpedo Station at Newport, R. I., a further order for 200 Standard dry batteries of his well known make. The results hitherto obtained by the government have been very satisfactory, hence this new proof of appreciation, constituting the best of testimonials.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, 32 Cortlandt Street, New York, manufactures and deals in a varied and extensive line of electrical supplies for electric light, telephone, telegraph and the household. These goods are the subject of a 352-page catalogue and price list just issued by the company. The catalogue, while very complete, is generously illustrated.

ECCLESTON LUMBER COMPANY, 29 Broadway, New York City, are very large manufacturers of cross-arms and poles, operating four mills exclusively on this work. They are desirous of forming a good connection with the leading foreign houses abroad to handle their products, constituting them sole selling agents in their respective territories. Correspondence on the subject is invited.

THE LYNN INCANDESCENT LAMP COMPANY, Lynn, Mass., not only renew lamps, but are themselves manufacturing a lamp which is claimed to contain the best available material, that is well designed and is manufactured under good methods and with good workmanship. The filament is a perfectly anchored one, the distribution of light is equal in all directions, and for street railway purposes it is believed that there is none that can surpass it.

MONTAUK MULTIPHASE.—The report of the committee on exhibits of the fourth annual convention of the National Association of Municipal Electricians at Wilmington, last September, pays a very high tribute to the Montauk multiphase cable, not only as a means of protection to property, but because "this invention will prove by its great general utility in the saving of life and property to be one of the most useful of the nineteenth century."

THE ENCLOSED TYPE OF RHEOSTAT has become a favorite type for motor starters during the past few years. In the most approved form the resistance material is in the shape of a reflexed ribbon which is embedded in sand, which sand is the filling material of a shallow box made entirely of iron or having one face of slate. A patent was issued Oct. 24, 1899, to H. Ward Leonard, which thoroughly covers the essential features of this form of rheostat box.

THE SIEGRIST AUTOMATIC OILING SYSTEM is fully explained and illustrated in an attractive pamphlet just issued by the Siegrist Lubricator Company, St. Louis, Mo. The system does not depend upon gravity for the circulation of the oil, but upon a high steam pressure. Besides many large half-tone illustrations of plants where the system is in practical operation, there is a folded inset sheet containing a diagram of the lubrication system of the power plant of the Southern Electric Railroad Company, St. Louis, Mo.

OIL FILTERS.—One of the features of economy and efficiency in the Woburn (Mass.) Electric Company's plant, illustrated and described by us recently, is the Cross oil filter and purifier made by the Burt Manufacturing Company, who have furnished a large number of lighting and power plants, electric railways, etc. In fact, the Cross oil filter has become such an accustomed element in the make-up of these modern plants, one takes it altogether as a matter of course.

MESSRS. FOOTE, PIERSON & CO., 82 Fulton Street, New York, successors to The E. S. Greeley & Co. manufacturing department, have just issued an illustrated catalogue of electrical supplies and apparatus manufactured and dealt in by them. This firm is sole manufacturer of the Blackwell combination telephone, Willyoung high grade measuring apparatus, the Argus lightning arrester, the W. B. G. accurate fuse protectors and other apparatus and devices well known in the trade.

THE SIMPLEX ELECTRICAL COMPANY, of Cambridgeport, Mass., has just issued a new catalogue descriptive of the unit system of enamel rheostats; also a new one on street car heaters. The various styles of rheostats and car heaters and the method of construction are illustrated in the catalogues, which contain, besides, a brief description of the principal features of the apparatus. The Simplex Company has brought out an entirely new type of car heater. It is of the enamel type. Besides possessing a large radiating surface, it affords no lodgment for dirt or dust, and is, therefore, of the cleanest form.

CYLINDER LUBRICATION.—The Joseph Dixon Crucible Company, Jersey City, N. J., has issued a pamphlet concerning the use of Dixon's Ticonderoga flake graphite for the lubrication of cylinders and valves. It is well known that the great heat of steam causes oil to lose more or less of its lubricating property. Experiments seem to demonstrate that a finely ground flake graphite furnishes a better body for mineral oils than any of the animal oils, and at the same time is not affected by any degree of heat, and moreover it fills up the microscopical inequalities of the bearing surface, making an ideally smooth surface.

PRISMATIC ELECTRIC SIGN COMPANY, of Williamsport, Pa., are introducing ingenious special apparatus for show window holiday attractions. It comprises a circuit changing device coupled to a mechanical motor, which will run from six to eight hours when fully wound. The device switches on and off automatically from circuits of four or five lights per circuit. It is all mounted on a polished base, with neat binding posts, etc. Large devices of the same character are built to order. To avoid disappointment, the company earnestly requests possible customers to get their orders in now, before the rush begins for the holiday trade.

ELECTRIC HAIR CURLER.—The Onota Manufacturing Company, Pittsfield, Mass., manufactures an electrically heated hair curler which is claimed to possess advantages over the ordinary forms of hair curlers. The heat is maintained inside the curler at the proper temperature to curl. When the device is in use it consumes about one-tenth of the current required by an ordinary incandescent lamp. An attachment plug is provided with each curler for connection with any incandescent circuit. The curler is neat in appearance and is made of aluminum. It is available for use in hotels, steamers, etc., where electric light is used.

ELECTRIC WIRE SUPPORT.—Mr. William B. Bragdon, of Cumberland Mills, Me., is manufacturing a wire support which is well recommended by those who have used the device. It is a tripod and is especially adapted for flat roofs. Among the points of superiority claimed for it may be mentioned the following: Simplicity and ease with which the parts are put in readiness for use; absence of welding, saving time and labor; the construction of the feet, preventing leakage where attached to the roof, and economy of space, one tripod supporting four wires, and when not in use the parts may be packed in a small space, making it convenient for storage and transportation.

LUNDELL GENERATORS.—The Sprague Electric Company evidently believes that first class products should be announced to the trade in a first class manner. This belief is evidenced in its trade literature, in which for artistic merit few concerns equal. The latest catalogue issued by the Sprague Company is No. 64. It deals in a very thorough manner with the subject of Lundell generators, direct connected and belted types. The latest machines, especially the larger ones, embody in their construction the "split pole" invention for overcoming field distortion. This feature, as all the other principal features of the machines under consideration, are briefly and clearly explained. The subject matter is liberally illustrated with artistic half-tones, showing the various features and details of the machines. Complete tables of dimensions are given together with diagrams.

HALIFAX, N. S. FAIR.—At the recent fair in Halifax, an exhibit was made of electrical apparatus, described as follows by the local papers: The most attractive display in the whole exhibition, from the standpoint of brilliance at least, is that of John Starr, Son & Co., in the manufactures building. It occupies a space in the centre of the main floor, where it cannot fail to be seen. It is a fairyland of electricity. From the ceiling of a large star-shaped pagoda, around the circumference of the roof, and along the stringers of the cupola are hung nearly four hundred electric lights, big and small. A handsome electrolier hanging from the centre is worth $200. The power for all this lighting is furnished by the firm's own dynamo in the machinery hall. The circling counter beneath this canopy of brilliance is covered with electrical apparatus, including fans, portable telephones, bells, etc. Telephones and switchboards manufactured throughout by Messrs. Starr are also shown, and the firm proudly announce that their sales in these goods are extending all over eastern and upper Canada. The display as a whole, with all its star-like glory, is a very striking evidence of the progressiveness of one of Halifax's leading enterprises.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED OCT. 24, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

635,287. TERMINAL FOR POLE PIECES OF ACCUMULATORS; E. Andreas, Dresden, Germany. App. filed April 11, 1899. The lug from each set of plates passes out through a cover and is surrounded by a cup of oil preventing creeping salts from attacking the terminal contacts. The cup and surrounding parts are further protected by a rubber sleeve.

635,319. CIRCUIT CONTROLLING DEVICE; J. Heinze, Jr., Revere, Mass. App. filed May 20, 1899. This is a switch specially adapted for electrical heating devices such as sad irons, soldering irons, etc. It is located in the handle of the heater and consists of a sectional rod, the parts of which are movable with respect to each other and acted upon by springs in such a way as to move automatically when the handle of the instrument is released by the operator.

635,373. ELECTRIC SWITCH; L. M. Downes and W. T. Sherman, Providence, R. I. App. filed Jan. 28, 1899. Structural details of a quick acting switch.

635,395. ELECTRIC CUT-OUT; J. Sachs, N. Y. App. filed Oct. 15, 1898. The inventor provides a material that surrounds the fuse wire, which will act as a flux for destroying an enclosing envelope which would hold the metal in a melted condition.

635,396. ELECTRIC SWITCH; J. Sachs, N. Y. App. filed Oct. 15, 1898. A fusible cut-out is made a part of the movable member of the switch.

635,441. RESISTANCE BOX; H. W. Leonard, N. Y. App. filed Nov. 3, 1898. The resistance in the form of metal ribbon or otherwise is placed in a metal box and surrounded by sand.

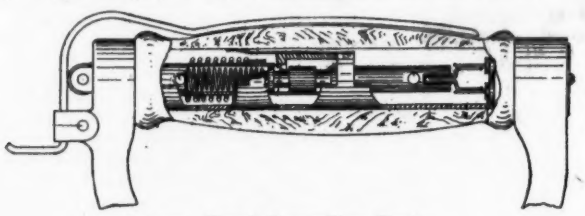
635,446. MEANS FOR GENERATING ELECTRICITY FROM CAR WHEEL AXLES; M. Moskowitz, Newark, N. J. App. filed Jan. 16, 1899. This invention is a means for mounting the dynamo on the truck of a car so that its pulley may be readily thrown into and out of frictional contact with a wheel on the axle.

635,447. ELECTRIC INCANDESCENT LAMP; W. J. Phelps, Elmwood, Ill. App. filed July 5, 1898. This is a multifilament lamp in which the circuits are controlled by rotating the globe. The socket contains three terminals one at least of which is resilient.

635,470. PROTECTIVE OR GUARD APPLIANCE; E. Frischmuth, Berlin, Germany. App. filed June 3, 1899. (See Current News and Notes.)

635,485. JUNCTION BOX FOR ELECTRICAL CONDUCTORS; R. L. Hundhansen, Wulmersdorf, Germany. App. filed June 26, 1899. The junction box is divided into a number of compartments provided with covers so arranged that only one compartment can be opened at a time. This avoids the liability of short-circuiting the exposed portions of the conductors contained in the compartments, each compartment containing conductors of one polarity only.

635,489 DYNAMO ELECTRIC MACHINE; M. J. Laschet, Darmstadt, Germany. App. filed July 3, 1899. (See Current News and Notes.)



635,319.—Circuit-Controlling Device.

635,490. REVERSING SWITCH FOR ELECTRIC MOTORS; E. T. Matlack, St. Louis, Mo. App. filed Jan. 3, 1899. The blades in entering the spring clips run against arc receiving blocks mounted on the ends of springs. The blocks protect the clips from burn-outs.

635,545. ELECTRIC ARC LAMP; D. Higgam, Cambridge, Mass. App. filed April 29, 1899. A method of effecting stability of current for an arc lamp on a direct current constant potential circuit consisting of effecting a varying supply of potential at the arc inversely to variations of current by magnetically operating a variable resistance in the arc circuit to vary the resistance of same with the variation of current.

635,587. FLUSH SWITCH; W. R. Pettis, N. Y. App. filed Jan. 23, 1899. A box constituting the switch base is set into another box located in the wall. The box carries spring plates forming one set of contacts and a cover for the box carries similar plates forming the other set. When the cover is adjusted the contacts are in working position.

635,629. ELECTRIC ARC LAMP; F. S. Worsley, London, England. App. filed Nov. 22, 1897. There is provided an arm which can turn on the same centre as the wheel, which operates to effect the striking of the arc and the feeding of the carbon. This arm is connected with the controlling device of the lamp and carries a part which forms, with the wheel, a receptacle in which is a wedging piece which bears more or less upon a gripping-surface of the wheel to move it at the proper time.

635,681. ELECTRICAL MACHINE; J. B. Hague, Horseheads, N. Y. App. filed April 28, 1899. This invention contemplates the employment of a cylinder covered with animal fur. By rotating the cylinder in contact with the body of a person beneficial effects, it is claimed, are imparted thereto.

635,691. ELECTRIC SWITCH; C. J. Klein, N. Y. App. filed Feb. 24, 1899. Details of a snap switch.

635,699. ARC LAMP HANGER; G. E. McCormac and S. J. Lapthorne, St. Joseph, Mo. This is a construction whereby the lamp may be raised and lowered by a single cord, and when in its elevated position will be sustained independently of the cord.

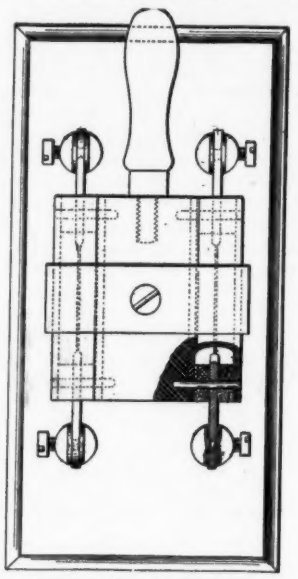
GERMAN PATENTS, ISSUED OCT. 4, 1899.

[In Charge of Dr. Ralph Julian Sachers, 120 Liberty Street, New York.]

104,575. ELECTRIC UNDERGROUND RAILROAD; Hermann Theodor Hillischer, Vienna. App. filed Sept. 25, 1898. There are provided two separate circuit closers for independently closing the main circuit between the feed wire and the sectional third rail on two different places and interrupting the same for the purpose of leaving one section of the third rail dead and harmless. The third rail consists of two parts, one below and insulated from the other. The electromagnet of a car actuates on a circuit closer which connects the upper part of the third rail with the lower, and at the same time on a second circuit closer which connects the feed wire to the lower part of the third rail by means of toggle links and a switch lever. As soon as the car passes the section, both closers will drop automatically.

104,713. DEVICE FOR AUTOMATICALLY PRESSING FRICTION-GRIP-WHEELS AGAINST THEIR RAIL; Siemens & Halske, Berlin. App. filed Sept. 1, 1898. The bearing of the shaft of one of the friction-grip-wheels is connected with the electromagnets of a coil in series, and one in shunt to the motor in a main circuit. The bearing of the shaft of the second friction grip-wheel is connected to the armatures of said electromagnets. The armatures will be attracted to the electromagnets and the friction grip-wheels pressed against the rail between them.

104,717. ROTATING CIRCUIT CLOSER; Rudolf Franke, Hanover. App. filed Dec. 11, 1898. In order to produce periodic curves after the method of Joubert, a rotating circuit closer is used, consisting of a contact disk and a contact brush for closing the circuit for only a fraction of time. Two brushes are located in the same plane of rotation, and are electrically connected at the moment when one of the brushes touches a metallic segment on the rotating disk, the other brush leaving the same.



635,396.—Electric Switch.

635,681.—Electrical Machine.

104,774. CURRENT CONTROLLER; Westinghouse Electric Company, Limited, London. App. filed May 4, 1897. The switch cylinder of a street car controller consists of a number of rings of insulating material, carrying the closing pieces. The rings may be separated by insulating disks of larger diameter. The links for the closing pieces are located within a sleeve of insulating material and fastened to the latter by means of connectors passing through the above mentioned rings.

104,775. MULTIPLE TRANSMISSION; Georg Moeller, Copenhagen. App. filed Nov. 6, 1897. A number of relays, in series or in parallel, adjusted for different current intensity, are located one beside the other. The armature of each is provided with an insulated circuit closer. The relays which answer to a given current intensity will close a local circuit provided with any suitable translating device. This will be accomplished by means of its circuit closer in connection with the circuit closer of the relays adjusted for the next higher current intensity. All the other relays adjusted for lower current intensity will attract their armatures, but on account of the relative distance between the armatures remaining the same, the local circuit cannot be closed by them. The different current intensities may be produced at the transmitting station by employing a number of resistance coils.

104,885. RECORDER FOR TELEPHONIC MESSAGES; Heinrich Eichwede, Berlin. App. filed June 15, 1897. Each of two telephone stations is provided with a series of control elements, which ordinarily counterbalance each other. A switch, actuated by that station which has been called, connects the control elements of the two stations in series, or cuts out one of the groups, in consequence thereof the current of both groups of elements, or of the remaining group, releases a clockwork at the calling station.

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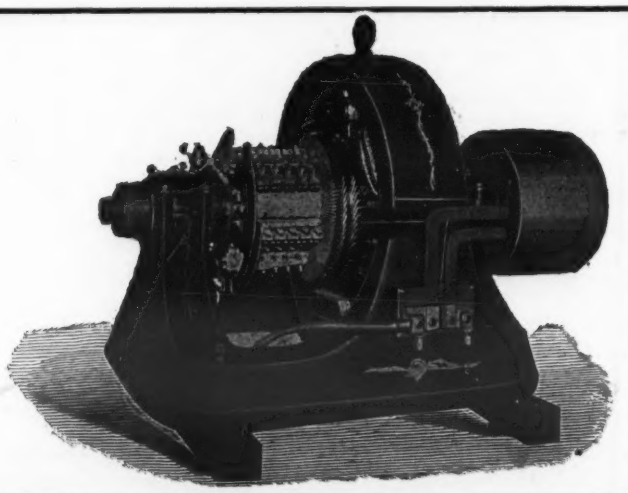

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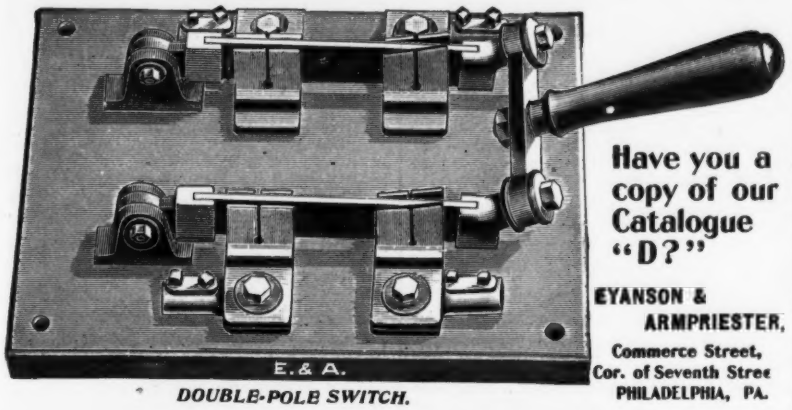

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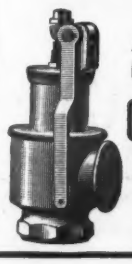

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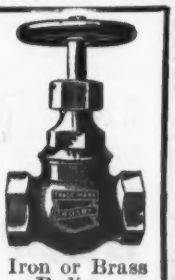

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